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Incident Report

Analysis and Repair of Kraft "Grate-It Fresh" Parmesan Cheese Dispenser

Overview

We fixed a broken Kraft "Grate-It Fresh" self-contained disposable parmesan cheese dispensing unit. This report details the incident, including the problem as it presented to us, analysis of the problem, and corrective action we took.

Situation and Problem

The investigators (Chris and James) were attending a Christmas banquet at which was served pasta along with grated parmesan cheese. The cheese was dispensed from a self-contained disposable unit, inside of which there appeared to be a block of cheese.



"KRAFT Grate-It-Fresh Parmesan Cheese is the easy way to get the bold flavor of freshly grated Parmesan cheese. This unique and convenient all-in-one package, with 100% pure Parmesan cheese and a built-in grater, dispenses freshly grated Parmesan cheese with each easy turn. It's the most convenient way to top off all your favorite dishes with the dynamic flavor of freshly grated Parmesan." (<http://brands.kraftfoods.com/KraftParm/parmProducts.htm>)

By rotating the dial on the bottom of the unit in a clockwise fashion, the cheese is shaved off the block and delivered to the plate by means of gravity. However, our cheese dispenser was not working. Multiple rotations of the dial delivered no cheese at all.

Someone had to save Christmas! We resolved to investigate and repair the problem if possible.

Analysis and Repair Process

1. External physical inspection ruled out the possibility of cheese exhaustion as a cause of the problem. By the weight of the unit and by visual inspection through the plastic case, we determined that about 1/3 of a block of cheese remained to be grated.
2. Also by visual inspection we determined the apparent mechanism by which the grater works is consistent with the cheese grater described in US patent 6,412,717. Specifically, a rotatable grating plate is attached to a threaded spindle that passes through the cheese and through a pressure plate on the opposite side of the cheese. By rotating the grating plate, the pressure plate is forced toward the grating plate by the threads on the spindle. This pushes the cheese into the blades of the grating plate. The grating plate and blades are plastic. The spindle and the pressure plate is also plastic. The spindle seems to be made of a softer plastic than that of the pressure plate.
3. Experimentation established that the mechanism was functioning at least at a minimal level by turning the grater in reverse and observing that the pressure plate pulled away from the cheese. Turning the grater in the correct direction (clockwise) brought the pressure plate back into contact with the cheese, pushing it into the grater. We then noted an increased resistance to turning

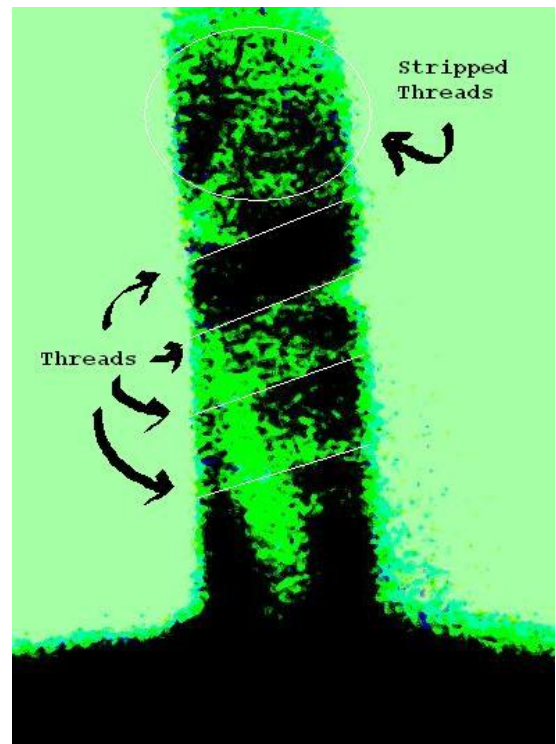
consistent with the pressure being placed on the cheese. However, the pressure approached a maximum, then eased, as if the pressure plate was slipping on the threads of the spindle. We conjectured that the threads were stripped.

4. Our first repair strategy was to push the cheese into the grater by hand. We thought that might move the pressure plate past the point where the spindle threads were stripped (assuming that the pressure plate itself was not damaged). To get at the cheese, we removed the grating cap with brute force (surprisingly this did not appear to damage it), which freed the entire mechanism from the enclosing plastic case. This allowed us to provide a great deal of pressure to the pressure plate, in addition that that of the damaged threads on the spindle. This strategy failed. No matter how much pressure we applied, very little cheese came through the grater.
5. This led us to a systematic examination of possible failure mechanisms. Here's what we came up with:
 - The grater blades may be damaged.
 - The grating plate may be warped so that the grater blades fail to engage.
 - The shape of the cheese face may cause the grater blades to fail to engage.
6. Visual inspection of the blades and grating plate failed to corroborate the hypothesis that the problem lay with the grater mechanism, whereas examination of the cheese block revealed grooves in the cheese face that perhaps could account for the blades failing to get any bite.
7. Our second repair strategy was to remove the cheese from the spindle, flip it over, and replace it so that the grater engaged a pristine face of cheese. This improved the grating by a little bit. At this point we returned to our first strategy and applied manual force to the pressure plate. This improved grating effectiveness dramatically, and slowly moved the pressure plate past the damaged portion of the spindle. We then reassembled the unit.

Outcome

The grater appeared to work.

Subsequent web searches on the product name suggested the probable cause of the initial failure: *The downward facing part of the cheese block dried out and became too hard to grate.* (Interesting that we did not consider the possibility of dried out cheese in our list of failure modes, in step 5. However, our repair strategy coincidentally worked, even though we misunderstood the root cause.) Other people online have experienced this. Apparently, the cheese is meant to be used within 14 days of breaking the seal. This seems like an unrealistic requirement.



Contrast-enhancement of low-res photo of spindle we were examining, showing healthy threads below the region of stripped threads. The pressure plate (at bottom) now rests on healthy threads.

Development Notes on “Incident Report”

By James Bach

Overview

I wrote this report as an exercise to help teach the art of performing an investigation and reporting upon it.

Maybe you are young, inexperienced, or a self-taught thinker. Maybe you'd like to compete better to get a job doing something that involves problem-solving or rapid learning. If so, then look for opportunities in your own daily experience to perform an investigation such as this, and write a report about it. Do several of them, and you will have a portfolio of your work to show prospective employers. Regardless of your formal educational background, showing examples of your work speaks boldly about what you can do.

Although this report describes an investigation. The general approach I've taken here can be applied to many kinds of reports.

General Approach to Reporting

I begin with the question “who am I serving with this report?” and then “what is my goal in making this report?” Usually, I am serving a paying client and my primary goal has to do with helping them solve some specific problem. That's a start. In this case, however, my clients are my students and colleagues.

My goal, here, is to successfully tell the story of a thought process. Success means several things:

- The reader obtains a clear picture of the investigation.
- The reader obtains a useful example of a report.
- The reader feels able to contribute to or criticize the investigation, based on the report.
- The reader learns how a simple event might become a showcase for scientific thinking.

In writing reports, there is nearly always another goal. The author may not be aware of this goal, but here it is:

- The author's own reputation as a thinker is enhanced and not diminished.

Remember: every report you write affects how people think about you. Your ability to reason, your eye for detail, your commitment, your professionalism, your care for others—all of these qualities and more are being evaluated in the minds of your readers.

I want to write a clean, simple report. I try to minimize clutter and text. I want it to be short, punchy, and readable. I use formatting to help the reader's eye find relevant information quickly, but I try to reduce the number of formatting elements in the document to avoid slipping into visual confusion. I'm not always sure if I succeed, but that's my goal.

Speaking of formatting, I used the “modern report” template, from Microsoft Word, as a base. Then I changed the fonts to Cambria and Calibri. I use Calibri for bold facing, since a non-serif font looks better in bold and helps to distinguish text from the un-bolded serified text in the body of paragraphs. Also notice that when I bold text inside a paragraph, I increase the size by one point. I use bolding for emphasis, occasionally italics, but never underlining. Underlining is messy and old-fashioned. I often highlight key ideas with bolding, so that the body of the text will not look like a big gray mass. This improves readability and browsability.

I want to help the reader come to his own conclusions even if they might differ from mine. To do that, I include not only my observations, but also information about how my observations were obtained and how they might be mistaken. I separate my inferences from the observations on which they are based (example “by visual inspection and weight...”) and show how one follows from the other. I

also consider including background information that will help the reader make a better assessment of what I did, such as the references to the patent and to the Kraft website.

The structure of the report should support the thinking the reader needs to do. As I design the report, I anticipate the questions the reader will have, and arrange for the answers to those questions to “pop out” from the text. In this case, I felt that a play-by-play narrative of the investigation would serve that need best.

I want to use professional vocabulary. Although it can be perfectly fine to write a report in an informal tone, I felt in this case it would be amusing to apply a more formal writing style to this trivial investigation. I was going for something like the rhetorical tone of an NTSB accident investigation. Aside from tone, I also wanted to practice “talking like a tester.” That means speaking with extra precision and objectivity, as compared to casual conversation.

Walkthrough

Let me walk you through the report to show you how I did it and why I did it that way.

James Marcus Bach and Chris Ojaste

12/25/08

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This is the masthead that comes with the “modern report” template in Microsoft Word. I like to use a minimalist approach: author, contact information, and date. In some situations I may include more information, such as who commissioned the report, or the version number of the report.

Incident Report

Analysis and Repair of Kraft “Grate-It Fresh” Parmesan Cheese Dispenser

Sometimes I struggle with the title of a report. The title is important, because the report may be sitting on a desk with lots of other papers. The title will be the part that catches the eye first. One way to title the report would be to make it quite specific. This can be fine for a one-off report, but usually a report I write is part of a series, or one example from a category of reports. So, I generally prefer a short title that identifies the type of report this is, then I provide specific information in the sub-title.

Incident report is an okay title. But I fear it’s a little too generic. Incident could mean anything. Investigation report might be better. I chose “incident” because one typical investigative situation is a customer coming to a technical support organization with a problem. These are often called incidents.

Overview


We fixed a broken Kraft “Grate-It Fresh” self-contained disposable parmesan cheese dispensing unit. This report details the incident, including the problem as it presented to us, analysis of the problem, and corrective action we took.

The purpose of the overview is to communicate the essence of the whole report so that the reader may decide if it’s worth reading at all. The essence of the report is that we found a problem and fixed it. But I can’t just write “Overview: we found a problem and fixed it.” I don’t want my report to sound generic—as if I’ve simply copied the text from another report. Anytime I write something that seems generic, I want to replace it with something that gives at least a bit of detail that is specific to the situation at hand. That’s why I named and described the object that we fixed.

Also notice that there is no table of contents in this report. The biggest problem with a table of contents in a short document is that it conveys the subtle message to the reader that the report is full of fluff that must be puffed up as much as possible to make it look more impressive. I'm annoyed with tables of contents in reports that are less than about fifty pages long. I think they are a waste of space. If the report is more than about 7 or 8 pages long, then I will list the sections of the report in the overview, but I won't give page numbers. It's a simple matter for the reader to find the sections in a short document.

Situation and Problem

The investigators (Chris and James) were attending a Christmas banquet at which was served pasta along with grated parmesan cheese. The cheese was dispensed from a self-contained disposable unit, inside of which there appeared to be a block of cheese.



"KRAFT Grate-It-Fresh Parmesan Cheese is the easy way to get the bold flavor of freshly grated Parmesan cheese. This unique and convenient all-in-one package, with 100% pure Parmesan cheese and a built-in grater, dispenses freshly grated Parmesan cheese with each easy turn. It's the most convenient way to top off all your favorite dishes with the dynamic flavor of freshly grated Parmesan." (<http://brands.kraftfoods.com/KraftParm/parmProducts.htm>)

By rotating the dial on the bottom of the unit in a clockwise fashion, the cheese is shaved off the block and delivered to the plate by means of gravity. However, our cheese dispenser was not working. Multiple rotations of the dial delivered no cheese at all.

Someone had to save Christmas! We resolved to investigate and repair the problem if possible.

The reason I describe the situation and problem is to show the focus and motivation of the investigation. This creates a tension that is resolved in the meat of the report. At the end of the report I go back to the top and ask myself if I have answered the questions or dealt with the challenges posed in the situation and problem section.

I initially expected to have separate sections to describe the situation and the problem, but there seemed to be too little to say about the each of those things, individually. Combining them created a better flow and a critical mass of content.

One of the little challenges in writing this was to describe the object we repaired. After trying to describe it in original words, I realized that I could use an official description of it, and a few moments of web searching brought me to the Kraft site. The description was brief enough that I could include it handily in the report. Anything included must be properly attributed, of course. In this case, the full link to the web page makes sense to include, so the reader can look up more information.

I took a cell phone picture of the actual unit we repaired, but when I discovered the Kraft website had a handsome official picture, I used that one instead.

Analysis and Repair Process

1. **External physical inspection** ruled out the possibility of cheese exhaustion as a cause of the problem. By the weight of the unit and by visual inspection through the plastic case, we determined that about 1/3 of a block of cheese remained to be grated.

I initially expected to have separate sections for analysis and repair, but as in the case of situation and problem, I ended up combining them. In this case, analysis and repair activities were intertwined. I didn't see a graceful way of detangling them.

I numbered the paragraphs to convey a sense of step-by-step order. In fact, the investigation bounced around a lot and branched. Reality is complicated, but part of the reporting process is to organize what happened into a comprehensible narrative. That means the flow of events I report are going to be a bit simpler than it happened in real life. In a complicated investigation I will often film it or take detailed notes to preserve the sequence of events.

In a narrative style of reporting, I strive to create anticipation and interest in the mind of the readers. That keeps them reading and thinking. I want them to follow along and get a sense of the things I considered, and the false steps I made as well as the productive steps.

The highlight of the first step of the investigation is the method we used to examine the grater. I wrote “external physical inspection” to distinguish what we did from plausible alternatives such as disassembling the unit, or reading about the unit online.

Note on phrasing: See the words “cheese exhaustion.” I suppose I could have written “...the unit had run out of cheese.” That would have been simpler and more accessible, but I was going for a more scientific tone. I once saw an NTSB report refer to “fuel exhaustion” as a cause of an airplane accident, so I emulated that.

2. Also by visual inspection we determined the apparent mechanism by which the grater works is consistent with the cheese grater described in **US patent 6,412,717**. Specifically, a rotatable grating plate is attached to a threaded spindle that passes through the cheese and through a pressure plate on the opposite side of the cheese. By rotating the grating plate, the pressure plate is forced toward the grating plate by the threads on the spindle. This pushes the cheese into the blades of the grating plate. The grating plate and blades are plastic. The spindle and the pressure plate is also plastic. The spindle seems to be made of a softer plastic than that of the pressure plate.

In order to report credibly about the investigation and repair of a mechanical problem, I needed to describe the mechanism with sufficient detail to allow the reader to appreciate the situation. As I tried to do that, I found myself making up my own terms to describe the various parts of the grater. After a few attempts writing in my own words, I realized that there might be a patent associated with the grater. That patent may include exactly the description I needed.

I went to Google patent search and quickly discovered a cheese grater from 1978 (patent 4,082,230) that looked something like the one we had repaired. I thought I would use that patent, until a few minutes later I thought perhaps I should search for “food grater” or just “grater” instead of specifying a cheese grater. This is because patents are sometimes written from the most general standpoint possible in order to maximize the scope of the patent. That search turned up exactly the invention I was looking for.

I considered pasting the exact description of the invention from the patent into the report. That didn't work well. The text was too long and complicated. Therefore, I settled for summarizing it using technical terms drawn from the two patents.

In making my description, I referred to the patent. That way I have a good reason not to explain the mechanism in any great detail, since the details are implicitly included by reference.

3. **Experimentation** established that the mechanism was functioning at least at a minimal level by turning the grater in reverse and observing that the pressure plate pulled away from the cheese. Turning the grater in the correct direction (clockwise) brought the pressure plate back into contact with the cheese, pushing it into the grater. We then noted an increase resistance to turning consistent with the pressure being placed on the cheese. However, the pressure approached a maximum, then eased, as if the pressure plate was slipping on the threads of the spindle. We conjectured that the threads were stripped.

I tried to make the steps consistent by putting the action first in each step. Each step begins with some variation of “we did this.” Here the experiment is briefly described. Just enough to create a reasonably detailed mental image in the minds of readers.

4. Our **first repair strategy** was to push the cheese into the grater by hand. We thought that might move the pressure plate past the point where the spindle threads were stripped (assuming that the pressure plate itself was not damaged). To get at the cheese, we removed the grating cap with brute force (surprisingly this did not appear to damage it), which freed the entire mechanism from the enclosing plastic case. This allowed us to provide a great deal of pressure to the pressure plate, in addition that that of the damaged threads on the spindle. This strategy failed. No matter how much pressure we applied, very little cheese came through the grater.


The first repair strategy failed. In a report that seeks to describe only the problem and the solution, it is not necessary to describe failed strategies. I included it because this report is also concerned with demonstrating the investigative process itself.

5. This led us to a **systematic examination of possible failure mechanisms**. Here's what we came up with:
- The grater blades may be damaged.
 - The grating plate may be warped so that the grater blades fail to engage.
 - The shape of the cheese face may cause the grater blades to fail to engage.

In real life, we did not say "let's systematically examine all possible failure mechanisms." What we did was bat around some ideas while each of us tried to force the cheese through the grater. In retrospect, however, our chatter seemed equivalent to an open brainstorm of reasons why the product was failing.

6. Visual inspection of the blades and grating plate failed to corroborate the hypothesis that the problem lay with the grater mechanism, whereas examination of the cheese block revealed grooves in the cheese face that perhaps could account for the blades failing to get any bite.

7. Our **second repair strategy** was to remove the cheese from the spindle, flip it over, and replace it so that the grater engaged a pristine face of cheese. This improved the grating by a little bit. At this point we returned to our first strategy and applied manual force to the pressure plate. This improved grating effectiveness dramatically, and slowly moved the pressure plate past the damaged portion of the spindle. We then reassembled the unit.



The narrative would be incomplete unless I show how we ruled out the various possible causes of the problem. That's done in paragraph 6, which leads into the second, successful repair strategy.

The picture of the spindle is crude. It was based on the photo, below, taken with my Blackberry. I should have photographed the spindle outside of the plastic case. It would have been much sharper. I didn't realize I was going to be writing a full report on this incident at the time of the investigation, or I would have taken (and included) many more photos. Photographs, diagrams, and video bring a wonderful dimension to investigative reports.

Because the photo of the spindle was so blurry, I used an image enhancement program to play with the contrast and color balance until I was able to see the threads. Then I added annotation using Microsoft Paint.



Outcome

The grater appeared to work.

Subsequent web searches on the product name suggested the **probable cause of the initial failure**: *The downward facing part of the cheese block dried out and became too hard to grate.* (Interesting that we did not consider the possibility of dried out cheese in our list of failure modes, in step 5. However, our repair strategy coincidentally worked, even though we misunderstood the root cause.) Other people online have experienced this. Apparently, the cheese is meant to be used within 14 days of breaking the seal. This seems like an unrealistic requirement.



Contrast-enhancement of low-res photo of spindle we were examining, showing healthy threads below the region of stripped threads. The pressure plate (at bottom) now rests on healthy threads.

In the first draft of the report, I forgot to include the simplest information about the outcome: that the grater appeared to be working. On reading through the draft several times, I fixed that.

Only as I was finishing up the report did it occur to me that I could use Google to discover whether anyone else had been experiencing problems with the Kraft grater. Sure enough there are several reports online. My first reaction to these was “don’t people have better things to do than to complain about a trivial food product on their blogs?” and then I remembered that is sort of what I’m doing by writing this report. Heh heh. People are motivated by lots of different things, I guess.

A troublesome element of the report is that it reveals a major oversight of the investigators: we failed to consider over-dried cheese as the cause of the problem. This makes us look bad, in a way, but in another way, including that information as a post-script shows that we might accept our mistakes and learn from them.

Potential Improvements to the Investigation

It can be difficult to decide how much investigation is enough. We felt satisfied with achieving the repair of the unit, but we hardly exhausted the possible branches of exploration and learning. Here are some ideas for what we could have done:

- We could attempt to measure the properties of the cheese block to quantify the amount of drying that has occurred. We could perform experiments to track the drying process. We could attempt to develop home-spun countermeasures to prevent the drying from taking place or reverse the drying process, then report on their efficacy.
- We could interview the homeowners to determine the history and provenance of the cheese grating unit. How long had they owned it? When did they first open it?
- We could search for more information online about the properties of the product and its reported problems.
- We could contact Kraft directly and ask about the product.
- We could try the dried cheese with traditional metal graters to see if part of the blame lies with the plastic grating plate.
- We could have consulted other guests at the dinner.
- We could have purchased several units and tested them in parallel.