The red crown jewels

Inaugural speech by dr. ir. Ricardo Weewer
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Prologue

The audience was shown a film prior to the inaugural speech. Shot by the Amsterdam-Amstelland Fire Service, this film was about a fire that broke out in Marnixstraat in Amsterdam in January 2015. The fire started at ground level and in the basement of an apartment building in the old city centre. Three fire fighters went in and were overwhelmed by the rapid progress of the fire. Two of them suffered severe burns. One of them found that his exit was blocked. For a while he thought that his life was over, until he realized that he could escape by jumping through a window. His colleague, who had the hose line, thought he had lost his buddy and tried to fight the fire to help his colleague to exit safely, but did not succeed. In the meantime, many people were hanging out of the windows and standing on balconies in both the burning flat and in the adjacent flats, at the rear and the front of the building, because they were unable to escape by way of the staircase.
In the film, fire fighters talked about their experiences during this fire: how they feared for their lives, and how difficult it was to get an overview of the situation.
The film has not yet been made public. Short footage of the fire can be found on YouTube

Ladies and Gentlemen,

I've watched this film three times now. And I don't know about you, but I find it very impressive, and always moving. It is not easy to find the right words after watching these images, and I had to think for a long time about how to start. The best thing to do seemed to call for a short period of silence.

Starting an inaugural speech by watching a film is not a customary thing to do. But when I watched this film for the first time, I'd just finished writing this speech and I was puzzled: the film visualises exactly what I want to talk about today. And how better to get a message across than by illustrating it with a true real-life example that includes the words of real firefighters? Images often express more than words.

The people who played the leading parts are in this room; I'm very happy they are here. For me, they are heroes. You don't often see people telling you so openly what literally happens to them in a situation like this. And I think that that's a condition for true learning. I take my hat off to you!

These people have done something wonderful: they rescued 11 people and put out the fire. At the same time, you see how unpredictable the growth of such a fire can be, especially in such an old city centre where you never know exactly how people have rebuilt and changed the homes behind those façades.

The film shows a striking picture of elements of the firefighting profession and how firefighters handle these as a team. I will refer to what you have just seen on several occasions in the course of this speech.

The question that arises in my mind, and possibly also in yours, after watching this film is: how can the professorship and the Fire Service Academy help to get our colleagues in the field to carry on doing this fantastic work, but without running those risks? What knowledge should we offer them to enable them to assess this fire development even better, if this is possible at all, or to contain the risks without compromising our vigour and decisiveness? That is the important question I face and that I will try to answer in part today.

Structure of the speech

I will argue that the work done by the fire service constitutes a profession and that developing knowledge is a must. I will be giving you some examples to address the myths, axioms and paradigms, and discussions that are now current in this discipline, and demonstrate that there is a lot that we don't know, or don't know for certain, and that Fire Service Science is a profession in its own right.

Next, I'd like to share something I struggle with. What if we were to develop a lot of new knowledge, or make existing knowledge generally available in the next few years, how do we make sure that the professionals in the field also have this knowledge and can apply it?

I haven't really figured this out, but it is the challenge we are facing. When preparing this speech, I examined what we already know about this topic and I will be making some suggestions to help us take a few steps along this road. I will be presenting a model and some components to illustrate this. Finally, I'll discuss what I would like to achieve with this professorship and how I intend to set about doing so. And logically, the programme for the next few years follows from what I argue in my speech.

But I'll start this speech by clarifying the professorship and its focus.

Fire Service Science as a discipline

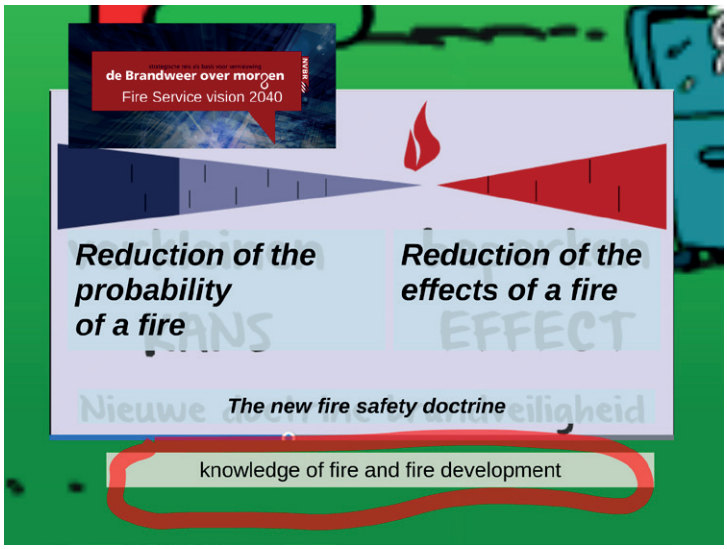
What actually is Fire Service Science, and what subjects should it cover?

In my view, Fire Service Science is about knowledge **of** and **for** the fire service. You might think now that this is a very narrow definition, and also very red! As regards the latter, I'd say yes, that's true! Fire Service Science is typically a red discipline. That doesn't mean that I don't find other disciplines in the safety domain important. On the contrary. But I have to admit that I think that the fire service has been occupied with so many other disciplines in recent years that it has failed to notice important developments in its own field. That's why it's now vital that we catch up and focus on our own discipline.

Is it also a narrow definition? No, I would say, certainly not! Knowledge **of** the fire service actually also covers the organisation, its leadership, its culture, its people, its vision for the future, etcetera. Knowledge **for** the fire service is also very broad, as its details cover all kinds of emergency assistance, such as water incidents, traffic accidents, containing incidents involving hazardous substances and of course fire prevention and firefighting.

In recent years, fire prevention has been expanded by actually preventing fires, promoting people's ability to leave a burning building without assistance, influencing behaviour and examining the causes of fire. Major developments have taken place in the field of firefighting specifically in recent years. These developments not only concern risks and techniques, but also safe working and the Human Factor. Truly a very broad discipline. It's clear that this calls for focus, since one can't do everything at once.

Luckily, there are three more professorships at the Institute for Safety (IFV): the professorship of Transportation Safety, the professorship of Crisis Management, and the professorship of Fire Prevention. This means that the Fire Service Science professorship does not deal primarily with those disciplines that have been allocated to other professorships, but it does have some ground in common with them as regards the fire service. Fire Prevention and Firefighting are based on the same basic knowledge: knowledge of fire and fire development. Fire prevention and firefighting actually constitute one single discipline.



The bow tie symbolises all the aspects of fire safety in one model. It is a diagrammatic representation of the "strategic doctrine of fire safety". This doctrine was developed as part of the vision programme that the fire service went through from 2008 to 2010: '*De Brandweer Over Morgen*' (Fire service for tomorrow). This vision was presented in 2010 and was updated last year. This vision shows how the fire service serves society. The development of the doctrine – starting from the doctrine of fire safety – and the associated development of knowledge are two important items on the strategic agenda, and they will continue to be so after it has been updated. The doctrine of fire safety implies a movement towards the front, the "probability" side of the bow tie, and innovation on the effect side, i.e. the actual firefighting. The professorship follows the fire service's vision. The professorship is subservient to what is necessary to make that vision come true. Fire Service Science is there to help the fire service. The importance of the professorship for society has thus also been established. It helps the fire service achieve its societal objectives.

As the main safety risks for firefighters nowadays occur during the actual firefighting, the focus of the professorship in the next few years will be on firefighting, but some flexibility will be allowed. Other developments will be monitored as well, and the focus will be readjusted if necessary. A dynamic profession deserves a dynamic professorship.

The innovation of firefighting focuses largely on increasing safety for fire service colleagues in the field.

You might now think: fire? Surely we already know a lot about it? It's what we do every day. And isn't there already a lot of experience, isn't the fire service profession all about experience? Every fire goes out in the end, doesn't it? Is knowledge development really still needed?

I am the last person to say that there isn't a lot of knowledge. After all, it's the very reason why firefighters have to study for years before they are allowed to start work. But let me run a number of axioms past you to illustrate this need to know more about fire, fire development and firefighting. What's important is that people have gradually become aware that fires are no longer what they used to be. Fire development has really changed because plastics react differently to fire than natural products: they produce more smoke and more energy.

Axioms

Surprise and inspiration...
I have been a professor at the Fire Service Academy for some years, initially part time. I'm still often surprised by how little we actually know of this profession, or to put it another way, by how things turn out to be different, or more nuanced, than I thought. There appear to be myths, axioms and paradigms.

An example: I, and many colleagues with me, thought for a long time that cutting a hole into the roof, or removing windows from a building would dispel the heat and the smoke, giving us a view of the fire and enabling us to enter the building to put it out. Cutting holes in the roof is common practice in the US, but it is also very dangerous, as many a firefighter has fallen through the roof. That's why we don't do it here. We remove windows. However, recent studies have shown that this is not always the right idea either, as it causes the fire to burn more fiercely.

Actually, we already knew this in theory, since oxygen is one of the sides of the fire triangle. But we didn't know that the effect is such that no hole will ever be large enough to remove all smoke! There are more phenomena like this that we know in theory, but we don't know exactly how great their effect is in practice. Applying theory in practice is one of our major challenges. But why do we actually wish to vent smoke and heat? Because we want to go in to find the fire and put it out! In the Netherlands, the UK and Sweden, we apply a different tactic than in the US. It's called anti-ventilation. Leave everything closed and smother the fire with high-pressure water-fog by going in. But fires have changed. We know that now. Plastics burn differently from the materials that were used in the past, and going in is not always a safe option any more. This means that we have to reconsider our methods in the light of this new knowledge. The usefulness of research is that we now look for other tactics. Innovation.
I'll come back to this example later.

So, venting won't always work. I say 'Not always'. I would like to say never, and it's really almost never, but sometimes it does work. Well, it's not an easy profession. "Because it depends." You will see that I have to give this answer very often. The best example of this is the study that the Fire Service Academy and the Netherlands Fire Service conducted in Zutphen last year. This was a unique study as it concerned a field study in real homes, with real furniture and frequently occurring scenarios.

Of course, we had thought in advance about how we expected the fire to develop. Would it be a fully developed fire or not, and would it spread outside the building? Much to our surprise, not a single fire developed fully or spread to the outside of the building. That did not match our ideas. After 45 minutes, the many spectators, including VIPs and lots of media representatives, asked: was that it? Everybody thinks of high flames leaping out of a building. But that the many colleagues who participated in this experiment recognised this picture too surprised me greatly. Contemporary and future fires will reach the outsides of buildings much less often. I initially really thought that we would be able to establish a standard fire development in these scenarios. But we found out that how a fire behaves in a real-life situation depends on many little things. The fires were also found to produce more smoke than we had thought, and to have a lack of oxygen even more quickly. Our conclusion: there is no standard fire development. 'It depends'. Another myth that existed was that the fire service was always too late because a fire is fatal after 3 minutes. Even if this were true, if you look at the factors that define survivability, there is always a probability that people do survive. We didn't know that. We do now, but there is still a lot of scientific debate about the question of when a situation during a fire is survivable and when it is not, and when exactly escaping becomes impossible.

> "So it depends."

But we also saw some new phenomena. We found that these fires died away due to a lack of oxygen. Now, what if the fire service is alerted and arrives when the fire is in this phase of the fire? The standard tactic will be that firefighters enter the building to rescue people and suppress the fire. But what will happen if oxygen is suddenly introduced?

The fire can develop again very quickly. Colleagues were also surprised about this. The cause might be a door being opened, but it could also be a window breaking suddenly. This makes the fire development hard to predict and that is quite dangerous. You also saw that in the film about the Marnixstraat fire. What do firefighters need to know to be able to rescue people and fight these fires safely? We need more knowledge of modern fire development to develop new tactics and techniques to be able to master such fires. The fire service does not want to find this out in practice and lose firefighters as a result.

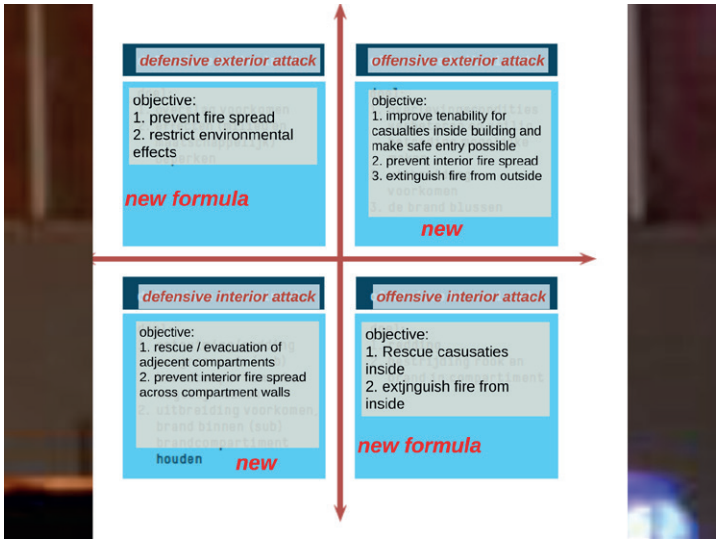
To enable true innovation, we need knowledge,

initially about how fires grow.

Another example: Here you see a 'wind-driven fire'. This is a fire that has reached the outside of the building, with the wind blowing across the opening where the flames are leaping out. Firefighters always check the direction of the wind. They have been taught to do so, since the most probable direction for a fire to spread is in the direction of the wind, but what we didn't know is that if the building is exposed to wind, temperatures inside can reach extremely high levels. Levels so high that it is dangerous to firefighters even when wearing full turnout gear. I remember that when I first read this, I thought: that only happens abroad and in high-rise buildings. It doesn't happen here. I had never experienced or heard about any such situation. When it became clear that it can also happen in ordinary blocks of flats with a communal stairwell/entrance hall (firefighters in London were injured in such situations), I thought of several incidents I had encountered in practice where colleagues had incurred burns during an interior

attack in the stairwell. We always attributed this to the fact that they had gone too far because the gear they wear offers ever better protection. Mmmm..... maybe it was a wind-driven fire after all? I don't know, because as this phenomenon was unknown in those days, evaluations did not explicitly consider whether the building was exposed to wind. What I do know is that we have to change tactics in such a situation. We need to start by paying attention to this aspect during the initial assessment.

A solution emerges right away:
You just spray into the building from the outside. That is the conclusion drawn from a recent American study. They call this a "transitional attack". The circumstances inside the building will improve substantially. But.... I have always been taught that spraying in from the outside is "not done". And I'm not alone in this, basically all firefighters think so. That's what we were taught. The underlying conception is that this will drive the fire into the building. That's one of those myths, based on uncomprehended experience. Please keep this notion of 'uncomprehended experience' in your minds for a while.



Spraying water onto flames from outside. We also do, or used to do, this when putting out major fires in large buildings. This practice has decreased in the past few years since the paradigm is: it doesn't achieve anything, since it won't put out the fire and it causes a great deal of water damage, with water that is polluted. But is this a myth or a truth?

The fire service developed the Quadrant model in recent years. This is a great example of an export fire service innovation product. The Quadrant model has already been translated into English and French and is also in use in the UK and in Belgium. It has even been translated into Russian.

The Quadrant model comprises four possible tactics: old tactics, such as the ‘defensive exterior attack’ and the ‘offensive interior attack’ and two new ones: the offensive exterior attack and the defensive interior attack. After the fire in De Punt where three of our colleagues died, the fire service started to consider whether entering the building is really always necessary. Providing these new tactics with effective techniques requires research and, in the past few years, the focus of the research conducted by the professorship has been on the offensive exterior attack. But, as this example shows, the old tactics call for innovation as well. Can they be done more efficiently, with less water or fewer people; can they be more effective?

In our search for effective ways to prevent the spread of fire, we have encountered many axioms that have turned out not to be as self-evident as we always assumed. When exactly does a fire spread to another room or building? Which physical phenomenon causes this? Radiation has been found to be important. But can radiation be stopped by water? Radiation is determined by the temperature at the source of the radiation: often flames. And that can be to the power of four. So, if the temperature of the flames is 2% lower, radiation will be 16% less? Might spraying into the flames then be effective after all? Or should we change something about the way in which this is done? We don’t know. This calls for research. Because less water, less environmental pollution, less fire spread, less damage?

The fire service rescues people and extinguishes fires. We are taught that rescuing always takes priority over extinguishing. Imagine this: you’re playing hide-and-seek with your kids in a corn field. Your children have all found spots to hide, when you suddenly see a combine harvester approach. What will you do? The most effective way is to stop the combine harvester. A fire acts like a combine harvester.

Does this mean that rescuing is always better than extinguishing first?

So we go in, take a hose with us, usually a high-speed hose, what we call a 'high-pressure hose'. We didn't use to do that in the past. We were taught that we had to close doors behind us and go looking for the fire. But nowadays we know that it's actually the smoke that is dangerous. Smoke is a fuel and it can ignite if temperature and oxygen levels are sufficient. That's why we bring a hose, to cool down the smoke. But that means that the door can't be closed, so we leave it open.
Three axioms together; I only have 45 minutes.

The high-pressure hose is convenient when you have to take a hose into a building. But its user friendliness comes with the disadvantage of high resistance, which means that it only expels little water. Modern day fires give off more power and require more water to cool them. Is the high pressure still enough then? In the film, we saw how our colleague Frans tried to put out the fire like a mad man, but he found this to be of little effect. And the same has been reported by several other colleagues, at home and abroad. This has led to an international discussion about whether the high-pressure hose should continue to be the standard. What should it be replaced by? Research is called for.

What is the effect on fire development if we leave the doors open? It has become apparent by now, including from the experiments in Zutphen, that open doors will fan the fire. But what's the effect of this? Fires will sometimes get out of hand, and sometimes they won't. It seems to be better to close them. But what about the hose in that case? Germany and the US apply "door management" and use "smoke stoppers". Innovation. And that's why we need to know the ins and outs: research in other words.

I have given you a number of examples of axioms, myths and paradigms that apply to the fire service profession. If you are not convinced yet, I have two more. They concern the human side of the profession. We saw major developments in this respect in the past year. I personally have become convinced that not enough attention has been paid to this human side, and that people should be an essential part of our profession. This concerns both the physical and the mental aspects of the profession. You can't really develop further and innovate without any knowledge of these two aspects.

The first one is about safe working. I was already extremely interested in the physical side of the profession, that is the effects of heat, physical effort, ergonomics; in short the ratio between the actual work load and the maximum permissible work load of people who have to carry out this profession in practice. I sometimes still practice with brigades from my former region. And when, on a hot day, you're in your hot suit, waiting in the fire engine, you know what it is like. You should try it. We've conducted an initial study into this subject to find out how far you can actually go into a building, carrying such a hose, to find people. Again, the general impression is that this is infinitely far. Well, forget it.
As you will have noticed, people have recently become worried about all kinds of hazardous substances that are released in a fire. This originates from the United States, but there has also been a lot of attention paid to this in the Scandinavian countries. It is no longer a matter of debate that extra measures are necessary. But just how considerable is the problem, and which measures are "as low

as reasonably possible", as stated in safe working conditions? We have a reasonable idea of which substances are released. But we don't really know how they are absorbed and to what degree. More knowledge about this is needed to obtain a carefully considered set of measures.

Besides the physical side, the mental side of the profession has also become increasingly important. Last year, the Fire Service Academy ran a study into 'command' in large-scale actions by the fire service. And I must admit that this was a real eye opener for me. This study was instigated by the large fire in Moerdijk. When that fire was evaluated, it was found that the fire service commanders had deviated from what they had been taught and what is in the instruction books. The fire service then organised its first learning arena, to be followed by two more some time later. A learning arena is a large-scale evaluation, in the presence of the people directly involved from the fire brigade in question, from high to low, supplemented by colleagues from all over the country. The goal is not so much to identify minor lessons, but rather to focus on what we call 'second-order lessons' or what you might call 'systemic faults'. During this learning arena, colleagues from all over the country recognized and acknowledged that deviating from the structure as taught actually happens everywhere. The question then is whether this is a good thing or a bad thing? And is this done because the fire service employs poor commanding officers, haven't they been trained properly or is there is a fault in the system?

This study greatly improved our understanding of how decisions are made when under pressure. This knowledge actually already existed; it was studied long ago: Naturalistic Decision Making, or Recognition Primed Decision Making it is called. Studies have shown that decision-making under pressure, so also in the fire service, takes place on the basis of recognition and, therefore, also on the

basis of experience. A commander under time pressure will first decide whether they recognise the situation and if so, they will repeat what they did before. They will check that the result is the same and, if not, make any adjustments required. The NDM theory also takes the pitfalls into account when people have to decide under pressure. Because it has been found that we humans then suffer from information overload (we can't process all the signals at once), a lack of situational awareness (no longer being able to see everything), time compression (we think that things last or take less time than they actually do) and tunnel vision.

Contemporary command structures do not take these human limitations into account. A study has also shown that, in an ideal situation, an organisation should be able to adapt to the environment in which it's performing its task. No two fires are alike, but still the fire service only has one type of command structure. The study, in which many firefighters from all over the country participated, resulted in the conclusion that the human factor should be given more attention. This starts with awareness of human fallibility. A further conclusion was that situational command, i.e. a more flexible system, leads to better performance.

I think that human fallibility especially, which is based on neurological principles, has been paid far too little attention. Because if people are fallible, relying on a "one-headed leader" for the entire incident control makes for a very vulnerable situation. This vulnerability concerns the system, but definitely also the leader. And this goes beyond large-scale action by the fire service; it affects the entire crisis management.
It is my opinion that this should lead to a paradigm shift both internally and outside the fire service. So people aren't perfect. Once we are aware of this, we can discuss it safely, and we can work on real solutions that will minimise the consequences. But we will also find out that experience can be misleading. Why then do we stick to the principle of recognition when deciding under pressure? We have to change our line of thinking: remove the pressure, take a bit more time. **Try to make decisions under less pressure, take a little more time to win time later.**

The study advocates that the situational command should be combined with efforts to achieve a "forgiving infrastructure". That expression was copied from traffic safety. If you know that things will go wrong, then you can ensure that the consequences are contained. One of the instruments that might help is a form of mindfulness: deliberately detaching oneself mentally. That would increase situational awareness. The good thing about this study is that experts inside and outside the fire service endorse its results. And that definitely helps in our efforts to try and reach *unité de doctrine* in this field.

The film about the Marnixstraat fire showed both Ruud, the crew commander, and Bert, the fire operation commander, saying openly: we couldn't handle this, it was too much. Bert literally said (he took part in the study), I wish I had taken that mindfulness course sooner. I think it's a great comfort for them to know that others would experience the same in that situation, and that this has nothing to

do with their knowledge and experience. However, this does give rise to the next question: how can we support these men in future when they have to make decisions under these difficult circumstances? And there is another aspect, which makes them heroes to me. They talk about it. So did the leader of the operational command team at the site of the incident, in Moerdijk, the instigator of this study. Another hero. Because he dared to be vulnerable, whereas the current paradigm inside and outside the fire service still is, that, if you can't do this, you'd better open up a fish and chip shop. Great guys! Because now this has been made clear, we can start working on a realistic and real solution. And that should lead to another perspective on decision making in a crisis.

I'm ending my plea with this final topic and I hope that, with these many examples, I have been able to sufficiently convince you that the work done by the fire service constitutes a profession.

Fire service work is not just:
- extinguishing a fire by dumping water onto the flames
- every fire goes out in the end
- the fire service let the building burn out in a controlled way?

The work of the fire service constitutes a profession that requires learning. A profession that you need to study for, that you need to acquire knowledge for and for which knowledge should therefore also be developed.

Knowledge development, not because the professor, who is of course preaching to the converted, happens to need a job, but to enable the firefighters in the field to do their work for a safe community safely, effectively, and - if possible - efficiently. To complement their highly diverse skills and tools by the knowledge that enables them to act and improvise in the many, often unexpected situations they may be faced with.

Knowledge development to enable innovation and to make it possible to stay up to date with the developments in society and the new risks they involve, anticipate them and, where necessary, react resiliently.

> Knowledge and experience of and for the fire service are the Red Crown Jewels.

Finally, I would like to share one more observation, or let's say 'insight' with you.
Based on all the knowledge that we have gathered from international literature and the studies carried out by the Fire Service Academy in recent years, I have come to the understanding that it's not an easy task to give one unambiguous answer to apparently simple questions. There are too many factors that determine how an incident develops.
Studies are always carried out under certain circumstances, but what if circumstances are just a bit different?

The experiments in Zutphen have demonstrated that fire development depends on many different factors, making fire development hard to predict: "it depends".
Recent studies in the context of the offensive exterior attack increasingly seem to demonstrate that it greatly depends on the situation which technique is the most successful, and sometimes it may be necessary to employ several techniques simultaneously or one after the other. Every firefighting tactic and technique can have its benefits and setbacks. This means that the choice of the tools that every fire service unit should carry with it and the choices to be made in specific situations are also correlated with the knowledge people have and the situation they encounter. The conclusion to be drawn from the study is therefore that the answer to many questions is "it depends". And therefore:

Improvisation will always continue to be necessary!

How do we bring the knowledge to our colleague fire fighters it is intended for?

And that brings me to the next topic I'd like to discuss. It's a question I'm often asked and I still struggle with. The question:
Say we bring all that knowledge together and we conduct all these studies? This would give us a lot of knowledge, but how does that contribute to professionalism on the work floor? In other words: how do we get this into the minds of the people who have to work with it? It doesn't matter whether they are the firefighters, the fire prevention advisers or the people who impart information in the context of Community Fire Safety. And is it actually possible?

Some people ask: What about all the knowledge and experience that already exists? Doesn't that count? And: isn't improvising key to the fire service profession? If every situation could be different, firefighters in the field will always have to keep improvising.

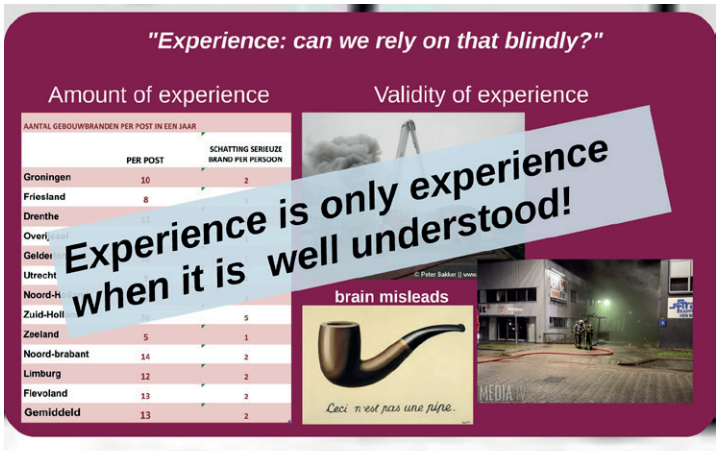
I think this conclusion is correct. But that does lead to the questions of what improvisation actually is, whether it's important to have knowledge for this, or whether you can "just try and see what happens".

And how can the fire service organisation promote and facilitate that capacity to improvise on the work floor?

A good reason to look into this. What's the situation regarding this experience and improvisation?

The theory of decision-making under pressure considers experience to be an important condition, because studies have shown that decisions taken under pressure are based on recognition; recognition of a certain situation. And that determines the first actions to be taken. According to this theory, we need a lot of experience to be able to recognize situations. Actually, this conclusion was reversed immediately. It's because it works this way that we have to support it. I'm not sure about that. Maybe we have to ensure that things will work differently. I think that might be an interesting subject for a study.

But let's assume that experience is a condition: do we have enough experience, and can we rely on it blindly? I don't think so. I will explain why by means of three arguments. The first thing I looked at, and this is actually a question that many people before me have asked, is: is there enough experience? Is the fire service profession actually a profession in which experience is key?



The available data (and there isn't a lot) shows that the average fire service unit turns out for a building fire some 10 times a year on average. This frequency is a bit higher in the provinces of Noord- and Zuid-Holland and a bit lower in rural areas. Most fires are routine jobs. It would seem to me that there is not a lot left for the average fire service station to do.

A second question is whether the experience of one incident can serve to determine how another incident is dealt with, especially against the background of "it depends". An example.

Two fires in roughly the same type of building. Earlier in this speech, I referred to the new understanding that venting is not always a good tactic. Sometimes it has the desired effect. Sometimes it doesn't.

In one fire, the fire service opens the overhead door and puts out the fire. In another situation, the fire service acts almost in the same way and with the same goal, but the premises will burn down completely. As a result, one brigade's experience will be that venting works, and they will do it again the next time. It's been less successful for the other brigade, but the question is whether they will attribute this to the tactic, and whether they will opt for another attack the next time, given the fact that not many alternatives are known... yet.

My position is:

> **Experience is not experience until the experience is understood**
> It's not the case that one method always works or always doesn't work. Therefore, it's important that we understand what exactly happened. Why did it work in one situation, and not in the other? We don't really study the why, or not enough at any rate. Is sharing experiences, which is being given a lot of attention at the moment, still sufficient in this case? I don't think so. Research should also be conducted into why a certain effect has been reached using a certain technique. Including when things go well. Only then will understanding occur and that is something you can share.

This means that the noun 'experience' does not mean the same as the verb 'to experience'. Not every experience leads to experiential learning.

This means that we will have to 'enrich' the experience and I call this enriched experience "experiential knowledge", which you have to share. Knowledge development and studies are necessary to be able to explain the course that an incident took in retrospect and to understand it.

And then we come to the topic of improvisation. When I started studying the literature on this subject I discovered that this is a discipline in itself. What is interesting is that there is considerable overlap with the literature on decision-making under pressure. That was my first eye opener.

You also see that a lot of literature on this subject can't actually be applied to the fire service. Studies about improvising often concern the 'arts': jazz music is famous for its improvisations, but there's also a lot of improvising going on in theatres. We see that organisations that are active in a dynamic market with significant risks try to find out how they can increase their capacity to improvise. They are what is known as 'High Reliability Organisations'. Here, improvising often concerns anticipating possibly unpredictable situations in the future. This is not easy for the fire service, since improvising does not become relevant until you're actually faced with the situation. So be it. There are however some things to be learnt from this that are interesting for the fire service.

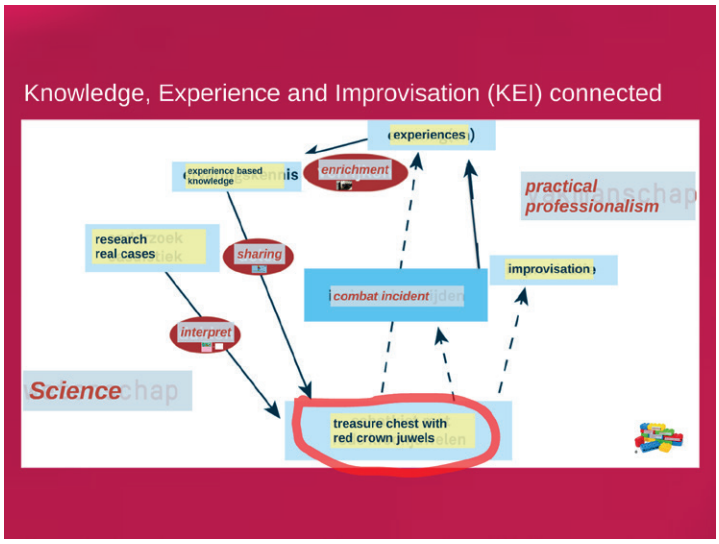
The first one seems to be self-evident “you cannot improvise on nothing”. There are fixed standards that people improvise on, also in jazz music. And doing a good improvisation is the result of working, studying and practising really, really hard!! I was rather surprised by that. It always looks so easy, that you’re made to think that people can do this spontaneously because they have a talent for it. Well, that’s not true.

A second important finding is that improvising is related to situational awareness (which means: having a reliable view of the situation). Weick’s conclusion is that mindfulness (which here means: concentrating on the here and now) increases situational awareness.

Literature on this subject also starts in about 1993 with Mr Weick who studied the incident of the forest firefighters in “Mann Gulch”, the details of which I think are known to everybody. Briefly: firefighters were killed in that incident because they stuck to fixed procedures. One of the superiors knew what to do but he couldn’t get that across to his team because it was something that was counter-intuitive for the others. He set fire to a patch of vegetation, lay down in it, and survived.

And this has brought us to the third finding: that “sense-making” (which means: jointly making sense of the situation) is very important. This makes the capacity to improvise not only dependent on detailed professional knowledge, but Human Factors come into play as well.

And finally the fourth point: In literature, improvising is described as “doing and learning at the same time”. This means that it is accepted that things can sometimes go wrong. To be able to accept that, the organisation must have a culture where people are not afraid to make mistakes. That is interesting. Does this culture exist in the fire service? It is my impression that the fire service easily improvises, but doesn’t yet really accept that mistakes will be made. That’s why I would again like to refer to the Marnixstraat film as an example. It’s not until we dare speak about dilemmas and possible mistakes so openly, that we really learn!



A lot is currently going on as regards knowledge development and knowledge sharing in the fire service. We have network meetings, our *Vakdagen* events for professionals in incident and crisis management and disaster control, an incident study day, the Fire Safety & Science congress, Facebook pages, websites and there is a lot of twitter activity.

I have made an attempt to correlate the elements of knowledge, experience and improvisation with each other in a model (The ‘KEI model’) and distil a number of ‘operations’ and components from this model. These components can help increase both experiential knowledge and the capacity to improvise on the work floor. This may not solve the entire problem. I also think that the organisation should create additional conditions, but I’ll get back to that later, and there may be other components. But I see it as a first step. A first step in which I see an important facilitating and instigating role for the Fire Service Academy and the professorship.

The KEI model works as follows:
The 'Treasure chest of red crown jewels' plays an important role in the model; it is the available knowledge and the enriched experience of the fire service. This treasure chest is filled with knowledge from studies. On the one hand, that knowledge is used to enrich practical experiences, and that enriched experience flows back into the treasure chest. On the other hand, that knowledge is used for interpretation: of action perspectives and standards that are easy to apply. Improvising will be necessary where the standards are deviated from.

There are three operations: 'enrich', 'share' and 'interpret'.

Experience is enriched at crew level.
At crew level, enriching takes place by evaluating incidents coordinated by a facilitator with up-to-date theoretical knowledge and understanding: up-to-date understanding on which there is national agreement. The entire group jointly studies why things went the way they did, even if the attack went well. Expanding incidents and drills with a way of indicating how an attack should have taken place, based on the current knowledge, would have added value to strengthen the learning process and make sure that firefighters get to know standard procedures through and through.

The combination of theoretical input and crew evaluation meets the two different dominant learning preferences (participate and obtain knowledge) within the fire service.

In my opinion, knowledge in the form of standards and enriched experience will be "shared" using modern channels that are already available, such as the e-learning environment, and I am adding something to this by means of the components. This will take place both top-down, through the formal system as a rule, and bottom-up, through informal channels.
The learning profile of the fire service was studied recently, in the context of the project on Strengthening Fire Service Education. And that was yet another eye opener for me. Because I always thought that firefighters learn from telling stories and from doing, and that they hate sitting in a classroom. In the world of education this is referred to as the learning preference of 'participating'. Telling stories and learning from them, sharing experience. But something funny seems to be going on. There is an equally large group of firefighters whose dominant learning preference is 'obtaining knowledge'. This group is underestimated in the fire service. I'm afraid that, after practice, this group will go home frustrated and say: 'haven't learnt anything again today'. My conclusion is that it is very important that we incorporate 'theoretical knowledge' into our drills, training programmes and the stories. But this requires a *unité de doctrine*. Because if authoritative firefighters don't agree on the basics, then every statement is just an opinion, and opinions are there to be made something to debate.... A characteristic of the hunter-gatherer culture.

Knowledge is required in order to develop standards, better understand experiences and interpret axioms and thus increase the capacity to improvise.

I imagine that we will further develop a number of components in the next few years, and of course I see a nice role for the professorship there.

Component 1: stories
Sharing stories about incidents is already quite common. This can be strengthened, especially by integrating theoretical interpretation into it. This will also serve that other group.

The film is an example of how experience is remembered better and appeals to people more

Component 2: Increasing learning from practice by using many more incidents that have really occurred as practice scenarios. Converting them into virtual environments enables lessons to be learnt from real incidents without the need for realistic practice all the time. That kind of practice not only costs a lot, but often it is hardly as realistic as the word suggests.

Component 3: firefighters participating in studies
This is something we have frequently done in the past few years: connecting professional skills with science. Practice has taught us that this leads to a lot of movement and increases the acceptance of research results. Interactions and discussion also take place on the spot. That helps create the unité de doctrine. It increases our learning and innovation capacities and increases the exchange of knowledge. So we have good experiences, and we can learn from the way the police handles this. Cees Sprenger mentioned this both in his inaugural speech and in his valedictory speech:
Studies are a component for social capital and an experience that the parties involved learn from and it can strengthen learning in the front line.

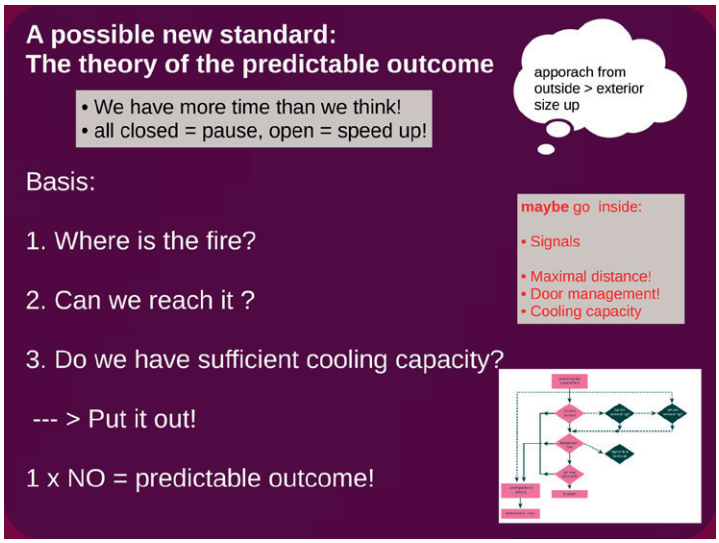
Component 4: the standards. Standard scenarios, procedures, tactics
The greatest challenge: converting knowledge into these procedures in the light of “it depends”. But it is necessary, as improvising can only work if it is based on standards. The Quadrant model can be considered a standard for tactics. And furthermore, I intend to collaborate with practitioners from the field next year to start describing a number of standard scenarios. I will give an example later of a simple standard based on recent research that I can already provide and that can be elaborated further.

Component 5: the fire service canon
Learning from our history. The incidents from the past lie stored in forgotten memory. A group of volunteers has now started to collect them and ‘dust them down’ as it were, and it’s striking to see how much has already changed in response to concrete incidents. But we tend to quickly forget this knowledge. I would say that the fire service canon should occupy an important position in training programmes and I would like to include the fire service canon in the “treasure chest of red crown jewels”.

And finally component 6: people
Attention to the human factors. There it is again: training in changing roles, having joint preliminary discussions about possible incidents in the catchment area, “sense making” and mindfulness as important elements of training and education. This doesn’t need to take a lot of time, but it does have a great effect on the capacity to improvise.

And now that standard that was promised: you will find an even simpler form of it in the booklet. The study group and I have been able to add some new elements in the meantime:

The theory of the predictable outcome



It's a basic model, for a simple situation. A fire in a building without any casualties. This model can be expanded and embellished upon later; this is one of the issues that the professorship will focus on.

The model is based on what has been learnt from the experiments in Zutphen (the fire that unexpectedly spread), and the knowledge that fires have truly changed. Besides this, research by the Fire Service Academy, for instance into the offensive exterior attack, has led to the conclusion that an attack directly in the room with the fire is the most effective, regardless of the means used, provided that there is sufficient cooling capacity. I say cooling capacity and not water, because this could also be done with other extinguishing agents.

I think that, based on that research, we can develop a standard that is based on simple principles, that might not be new, but that do represent a different mindset.

The NEW aspects of this model are:

1. that the approach is outside in instead of inside out
2. that we realise that there is more time than we thought for a thorough exterior assessment (size-up), and that we will pay more attention to this.
3. that modern fires can require a higher cooling capacity
4. that ventilation plays a major role in sudden fire spread.
5. that we realise that the distance we can travel inside a building is much shorter than we used to think.
6. that spraying in from the outside can improve circumstances inside a building (transitional attack).

Let's look at a standard scenario of a fire in a building without casualties. This would, of course, be more complicated if there were casualties. The standard then is: locate the fire, preferably from outside, and once you have found it the next question is: can the fire be reached from outside? If so, you only need sufficient water: so, do I have enough water? Then you put out the fire.

The possibility of an interior attack is only considered if the fire can't be reached from outside, but then special conditions apply which I'll address later. However, if the seat of the fire can't be reached (either from the outside, or because the conditions for reaching it by entering the building can't be fulfilled), or if not enough water is available, the outcome is predictable. The fire will spread and the building will burn down. This predictable outcome doesn't only apply to fire suppression. It's a rule that can also be

used for prevention, as advice for users and owners. If the building is one compartment, with a low level of prevention leading to rapid fire spread, and a lot of water being needed which is not available, then the premises will burn down in a predictable manner. The fire service can't do anything about this and this is something which can be communicated in advance.

I can almost hear you think that this all sounds very obvious and straightforward. We often used to do things this way in the past, but since the fire service started going into buildings, the dominant practice has become to locate the fire from within. However, with modern fires this is often not possible anymore nowadays, and if we do opt for this tactic, this will require fire gas cooling, etc... Modern techniques sometimes work against you. In this context, I have been known to refer to the "retro-fire service" because we've seen that fires have truly changed these last few decades, and have become fiercer, hotter and/or produce more flammable smoke. I suppose that explains why it is more vital than before that exactly the right techniques are applied.

Please note: this is a new understanding, based on recent studies and an interpretation made together with people working in the field. Things don't work this way yet. Education and training still mainly assume an interior attack.

But what if the fire can't be located from outside? Or if it can't be reached from outside?
In that case, a few principles apply:

- When entering: heed the signals: smoke is fuel, openings provide oxygen and ignition is always possible. This says something about the maximum distance that you can go into a building in order to reach the seat of the fire. This is not really a criterion that is considered yet, unless the 'depth of attack' as we call it would be greater than the length of the hose.
- Door management: everything closed = fire paused; creating an opening equals hitting the gas → this gives you time to think. Time which we now think we don't have. But there is time. An interior attack requires that as many doors as possible in the direction of the fire are closed. And then you have to vent the rooms room by room.
- Bring sufficient water if you expect that the fire could spread, for example due to a window breaking (this has also led to the discussion about high and low pressure that I referred to before).

I intend to further elaborate the theory of the predictable outcome in conjunction with practitioners and so contribute to the theoretical knowledge we have recently gathered. I will work on this with the study group that has been set up, consisting of colleagues who are really involved in this discipline. A nice and fun group!

Conclusions about how knowledge can further help

I hope that, through this discourse, the model and the components, I have been able to demonstrate that I think that knowledge helps to enable the work to really be carried out more safely and more effectively, and that learning can also be stimulated on the work floor. The professorship will focus on further elaboration of those components.

I would like to end with a few notes on the fire service as an organisation. This is intended specifically for the fire chiefs in this room.
I have attempted to answer the question of how we will be able to bring all this knowledge to the people we do it for. You may have noticed that I haven't really found an answer to this. The challenge of developing interpretation and simple perspectives that work most of the time is greater or less great, depending on how the fire service organisation will be set up in the future.

I have noted for some time that the fire service is at a crossroads. Some people in the fire service think that much more knowledge is needed to enable firefighters in the front line to make decisions themselves, based on their own observations. Others think that the current study load is sufficient. The question is whether all this knowledge can still reach all the firefighters and whether the fire service should want it to. We have some 28,000 firefighters in the Netherlands, some 4,000 of whom are professionals, and 24,000 who are volunteers. They each only have limited time available. The question is whether this is still possible if everyone needs to know and be able to do everything. This speech was only about fire. But emergency assistance also calls for ever more knowledge. I think that a choice will have to be made in the near future. Will the fire service continue to opt for generic firefighters or will the fire service differentiate?

How and to what extent the challenge concerns formulating simple standards (which, as we have seen, will not always provide the right solution) also depends on the choices made in this respect by the fire service organisation. The organisation should actually support this process.

There's another *cri the coeur* or 'heartfelt desire' that I would like to voice here. I have noticed that the organisation is looking intensively for something or someone who is knowledgeable about the subject matter. Especially these days, where so much has changed or seems to be uncertain. The fire service is currently lacking something or someone who can give reliable advice as to 'the facts' according to the current state of science. People often look to the professor then. But he doesn't know everything either, and it wouldn't be good to depend on just one person. I'll just call them the 'number one monkey' on the subject matter.
An organisation that increasingly attaches value to professionalization will also have to position the professional in the organisation. I have noted that, at all levels in the organisation, there are only few people who are allowed to only concern themselves with the subject matter content.

Firstly, the knowledge has only been vested with a few people. As a result, difficult questions that call for modern understandings cannot always be answered.
Secondly: the Fire Service Academy researches and teaches. It needs specialist teachers, with up to date knowledge, instead of ones who only disseminate existing or old thinking. The best would be for these people to also be connected, i.e. to be rooted in the Fire Service regions. This calls for people who are given the scope to actively engage with this.

That is what the number one monkey can provide. And that number one monkey should not be one person. I would like to compare it with a body like the Social and Economic Council of the Netherlands which consists of a group of authoritative people who have been given their 'clients' trust. The number one monkey would be appointed by the Board of Fire Chiefs and would have to shape the scientific discourse, and, ultimately, based on the latest new understanding, be able to advise as well as monitor the *unité de doctrine*. I am calling on the Board of Fire Chiefs to give shape to this in some way. Of course this also implies that, besides the "management line", a subject matter line should be created, as well as a dual career development path. This gives the fire service an opportunity to give shape to its further professionalization.

After this *cri the coeur* I would like to conclude my speech with what I, in my capacity as professor, would like to achieve with the professorship over, let's say the next five years. I can't look beyond that now. The world is too dynamic for that.

The ambitions of the professorship

When I was asked to take the position of professor, I did so after extensive consideration. The Amsterdam brigade was close to my heart and, as a born and bred *Amsterdammer*, you don't easily leave such a beautiful brigade. I had already become involved with various projects and fora throughout the Netherlands, such as 'the strategic journey', fire studies, the Scientific Research Council and the Regiegroep Innovatie (Control Group on Innovation). After all, my main drive to accept the position was that I saw that this would enable me to do more for the fire service, firefighters and private citizens.
I had already discovered that there are still many things that we don't really know too much about.
So what can then be better than being able to actively help gather knowledge? And I was also very sorry that there was not a unanimously positive image of the fire service academy in the Netherlands.
Convinced that the main issues can only be solved in unison, I actually thought that there would be an important role that such a fire service academy could play. And I saw that many firefighters also really wanted this: a fire service academy that is a leading authority, and a landmark for all the firefighters in the country. And so that is also now my mission.
I think that the Fire Service Academy and the professorship have important roles to play in order to achieve the components and the model I have just presented to you.

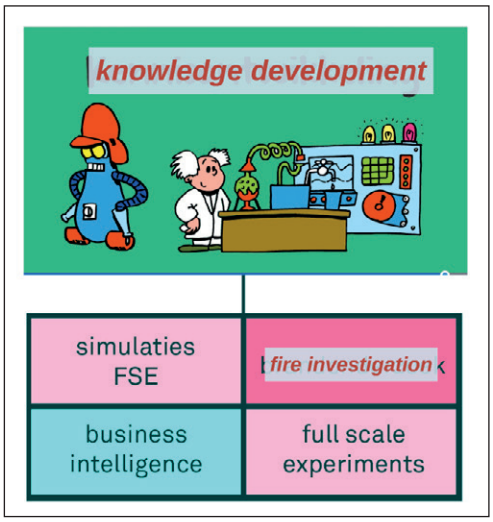
Such a fire service professor calls for visibility, instead of a professor who is sitting writing beautiful articles in his study. That is why I will try to be a professor who is visible and connected, and an ambassador for the profession.

Visible in the field, visible to firefighters, visible in the regions, and at national and international knowledge institutions as much as possible, and visible in the scientific field. Visible to fire service colleagues at conferences, such as the Fire Safety and Science conference, which we deliberately make easily accessible and which we stream online, so that everyone can follow it, also at the stations.

The main goal continues to be to connect science and professional skills. In other words, conducting research with professionals from the field for the people in the field. Research as an experience where people learn from each other and that strengthens the social capital (Cees). Cees has recently taught me that this is called participatory practice-oriented research. It's always nice when you can put a name to something.
This approach has already proven its worth during our practical experience in Zutphen and with the experiments at Troned. Firefighters love being there and participating, and they consider it a form of appreciation for their profession when research is finally carried out.

Connected with the field, answering topical questions, answering the questions asked by the fire service and by society. Connected with professionals by bringing them together in study groups and expert teams. But also connected with scientists at home and abroad.

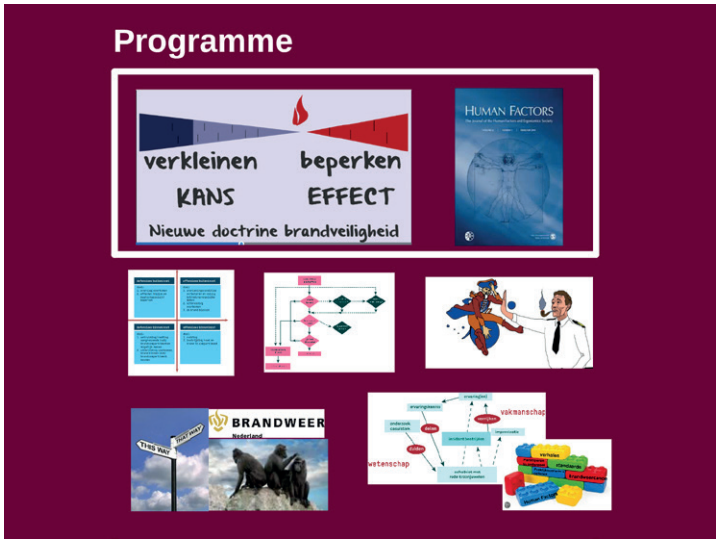
I've noticed that we do not have something like a real fire service research community yet. Research is being undertaken abroad too, but to be fair: there is little connection, and there is no scientific discussion about results. Many articles refer to the same old study and were written by retired fire chiefs who employ their authority and experience to add another opinion. My ambition is to connect with researchers at home and abroad to establish such a community. I particularly aspire to work together with other countries and to have studies conducted there. There is strength in numbers. It would be nice if we could also gather knowledge from research carried out by others.



We should also be connected with different forms of research. In my experience, a combination of different research methods is needed. Practical experiments are usually conducted in specific situations. Speaking strictly scientifically, those conclusions only apply to the situation studied. I then often hear in the field... what planet are you from? We hardly ever see this in practice. Connecting this practical experience to experiments, by collecting case studies, conducting fire studies and maintaining a sound collection of data provides direction to experimental research and an understanding of the actual practice.

Business Intelligence features high on the agenda now. Business intelligence serves to enable people in the organisation to achieve the organisation's goals in a smart manner. That goes beyond mere management information with dashboards. Information is also very important for research. And finally, I have come to another realisation. I always thought that simulated models could predict everything and would be most useful for designing experiments. I was wrong. The models are not sufficiently sophisticated yet and high-quality, modern input parameters are lacking. So that calls for experiments. This means that there is interdependence. Business Intelligence, Practice-oriented research, Fire Safety engineering modelling and studying real fires are thus inextricably connected and all these forms have to be employed to develop the knowledge that is needed to increase safety in society and the safety of firefighters in particular.

Today, I was mainly an **ambassador** for a while. I have found out that many people think that the work done by the fire service constitutes a profession and that knowledge development is needed, but this is not communicated enough yet. When I give presentations about the research we do abroad, everyone is enthusiastic. The causes of fires and the safety of firefighters are subjects that everyone find important. Only few countries have put this on their agendas. Hats off to the Netherlands! Getting Fire Service Science on the European agenda requires a lot of 'ambassadoring'!



It will be clear that the programme for the next few years follows logically from the issues I addressed in this speech. Don't worry, I am not going to repeat them...

Conclusion

Ladies and Gentlemen,

I have come to the end of this speech.
I would like to end by firstly thanking you all for coming here and listening to this story. I am most honoured by your presence.

I hope that I have sufficiently convinced you that the work done by the fire service constitutes a profession and that knowledge development is necessary, if you were not already convinced of course, and I count on your support for the implementation of the professorship's plans.

And finally I would like to thank the people who inspired me to formulate the ideas for this speech and to write the speech. The people who have provided their comments on the draft versions, my fellow-professors, colleagues from the study group, fire chiefs, friends and fellow-firefighters who keep telling me their honest stories that are a source of inspiration to me.

I would like to thank the leading actors in the film "Marnixstraat 117" for letting me show the film and I am happy that you are also here with us.

I would also like to thank the board of the IFV for the opportunity to give this speech and for pressuring me to do it now. I would specifically like to thank Wim Beckmann. He is the manager of the Fire Service Academy, and was the chairman today. He isn't often in the spotlight, but I can assure you that, behind the scenes, he is a great supporter of the professorship. And that does him much credit.

Lastly, I would like to thank the Netherlands Fire Service, the Board of Fire Chiefs, and the firefighters from the field for the trust they continually put in me, and the support that they give to the professorship.

And now a few words from the protocol:
I accepted this professorship gladly and in full confidence, and these feelings have only grown stronger. I will fulfil this professorship with common sense, I will be visible and connected and an ambassador for the profession.

I will continue to strive towards our mission:
the safety of our fellow firefighters **and** society. Joining together professional skills and science **and** a fire service academy that is authoritative and a flagship for the fire service domain.

The work of the fire service **and** the people in the fire service are an inexhaustible source of inspiration for me. I am constantly in the presence of researchers, teachers and colleagues who never cease to inspire me and for which I am eternally grateful.

Thank you for listening to me.