

Digital Laws and Natural Language Processing for the future of workforce

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This workshop



We will tackle the challenges of a digital society that combines digital productive processes and its regulatory context:

- How to add transparency & accountability to decision making?
- How to discover processes from data, and how they comply with regulations?
- How to make laws more understandable?
- What happens when laws or processes change?



WHO ARE WE?



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Assistant Professor DIKU
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Research in Software Engineering and
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Daniel Hershcovich
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Research in natural language, X-Ray
Imaging, data augmentation

Political focus

The screenshot shows the homepage of the Agency for Digitisation, Ministry of Finance. The header includes the logo, navigation links for Contact, About us, News, Dansk, and a search icon. Below the header are four main menu items: Policy and strategy, ICT portfolio management, Data and IT architecture, and Digitisation. The 'Policy and strategy' menu is currently active. The main content area shows the breadcrumb navigation: Home > Policy and strategy > Digitisation-ready legislation. To the right of the breadcrumb are sharing icons for Facebook, Twitter, LinkedIn, Email, and Print. The main title is 'Digitisation-ready legislation'. The text explains that the Danish welfare system is one of the best in the world, but as the public sector has developed, case processing has become increasingly complex. Denmark aims at simplifying legislation in order to promote automated digital case processing. Below this is a section titled 'Simple regulation, less bureaucracy' which states that from 2018, it is mandatory to assess whether new legislation is ready to support digital case processing. The Government has established seven principles for "digitisation-ready" legislation that ministries will follow, when they write new legislation. A link is provided to learn more about the seven principles. The footer contains a 'Contact' section with an email address (sg@digst.dk) and a 'News about digitisation-ready legislation' section with a single item.

AGENCY FOR DIGITISATION
MINISTRY OF FINANCE

Policy and strategy ▾ ICT portfolio management ▾ Data and IT architecture ▾ Digitisation ▾

Home > Policy and strategy > Digitisation-ready legislation

Share with:

Digitisation-ready legislation

The Danish welfare system is one of the best in the world; but as the public sector has developed, case processing has become increasingly complex. In the years to come, Denmark aims at simplifying legislation in order to promote automated digital case processing.

Simple regulation, less bureaucracy

From 2018, it is mandatory to assess whether new legislation is ready to support digital case processing.

The Government has established seven principles for "digitisation-ready" legislation that ministries will follow, when they write new legislation.

[Learn more about the seven principles for "digitisation-ready" legislation](#)

<https://en.digst.dk/policy-and-strategy/cutting-red-tape-in-denmark/>

Contact

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News about digitisation-ready legislation

› New agreement will make legislation ready for digitisation

Compliance

The act/process to ensure that business operations, processes, and practices are in accordance with prescriptive (often legal) documents¹.



1. G. Governatori, Representing business contracts in RuleML. Intl Journal of Cooperative Information Systems 14, 181-216. 2005

Compliance



Decision processes
(e.g. loan application)

```

    /**
     * @return the CPRNumber
     */
    public String getCPRNumber() { return CPRNumber; }

    /**
     * @param CPRNumber the CPRNumber to set
     */
    @XmlElement
    public void setCPRNumber(String CPRNumber) {
        String oldCPRNumber = this.CPRNumber;
        this.CPRNumber = CPRNumber;
        propertyChangeSupport.firePropertyChange("PROP_CPRNUMBER", oldCPRNumber, CPRNumber);
        int CPRYear = Integer.parseInt(CPRNumber.substring(0, 2));
        int CPRMonth = Integer.parseInt(CPRNumber.substring(2, 4));
        int CPRDay = Integer.parseInt(CPRNumber.substring(4, 6));

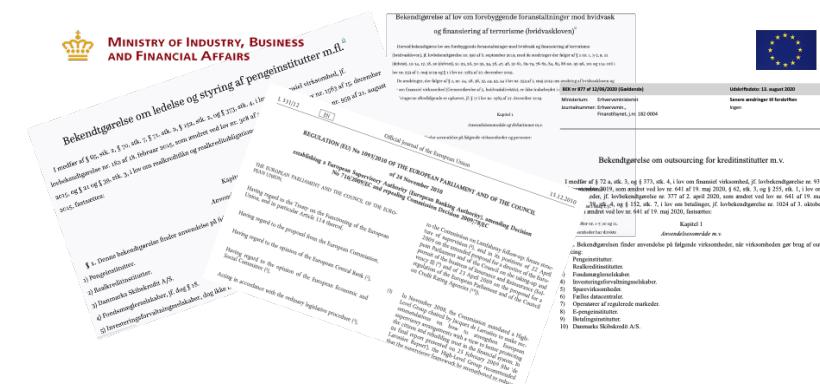
        Calendar birthday = new GregorianCalendar( year: 1900+CPRYear, CPRMonth, CPRDay);
        Calendar today = new GregorianCalendar();
        today.setTime(new Date());

        int deltaYears = today.get(Calendar.YEAR) - birthday.get(Calendar.YEAR);
        int deltaMonths = today.get(Calendar.MONTH) - birthday.get(Calendar.MONTH);
        int deltaDays = today.get(Calendar.DAY_OF_MONTH) - birthday.get(Calendar.DAY_OF_MONTH);
        this.Age = (deltaYears*12+deltaMonths*30+deltaDays)/360;
    }
}

```



Norms, standards
& best practices



???

Is my process compliant?

The system says no!

AIR PASSENGER RIGHTS

DENIED BOARDING? CANCELLED? DELAYED FOR A LONG TIME? Airlines have a legal obligation to inform you about YOUR RIGHTS AND WHERE TO COMPLAIN

Reduced mobility

Identity of the airline

Liability

Assistance by airlines

Package holidays

Time Out

Reservation

Booking

Notifying Cancellation

```
graph LR; Start(( )) --> Reservation[Reservation]; Reservation --> Booking[Booking]; Booking --> NotifyingCancellation[Notifying Cancellation]; NotifyingCancellation --> End((( )); TimeOut[Time Out] --> Booking;
```

Digitalization of data or digitalization of processes?

politiken.dk/inland/art7489320/Udgifter-til-nye-ejendomsvurderinger-eksploderer

POLITIKEN DANMARK SAMFUND POLITIK UDDANNELSE KØBENHAVN UNDERSVINSNSPRISEN **☰ MENU**

ønsker. Arkivfoto.

DANMARK 12. NOV. 2019 KL. 21.30

HANS DRACHMANN Journalist

ANDERS BÆKSGAARD Politisk redaktør

LÆS ARTIKLEN SENERE

f t e g

ALT DU BEHØVER VIDE FRA MORGENSTUNDEN

Tilmeld dig vores morgenneyhedsbrev og lad os give dig en god start på dagen med et håndplukket overblik over de væsentligste nyheder

Indtast din email Tilmeld

Udgifter til nye ejendomsvurderinger eksploderer

De samlede udgifter til nyt vurderings- og boligskattesystem er på 3 år steget fra 2,7 til mindst 4,7 milliarder kroner. »Det er mange penge at bruge«, medgiver minister.

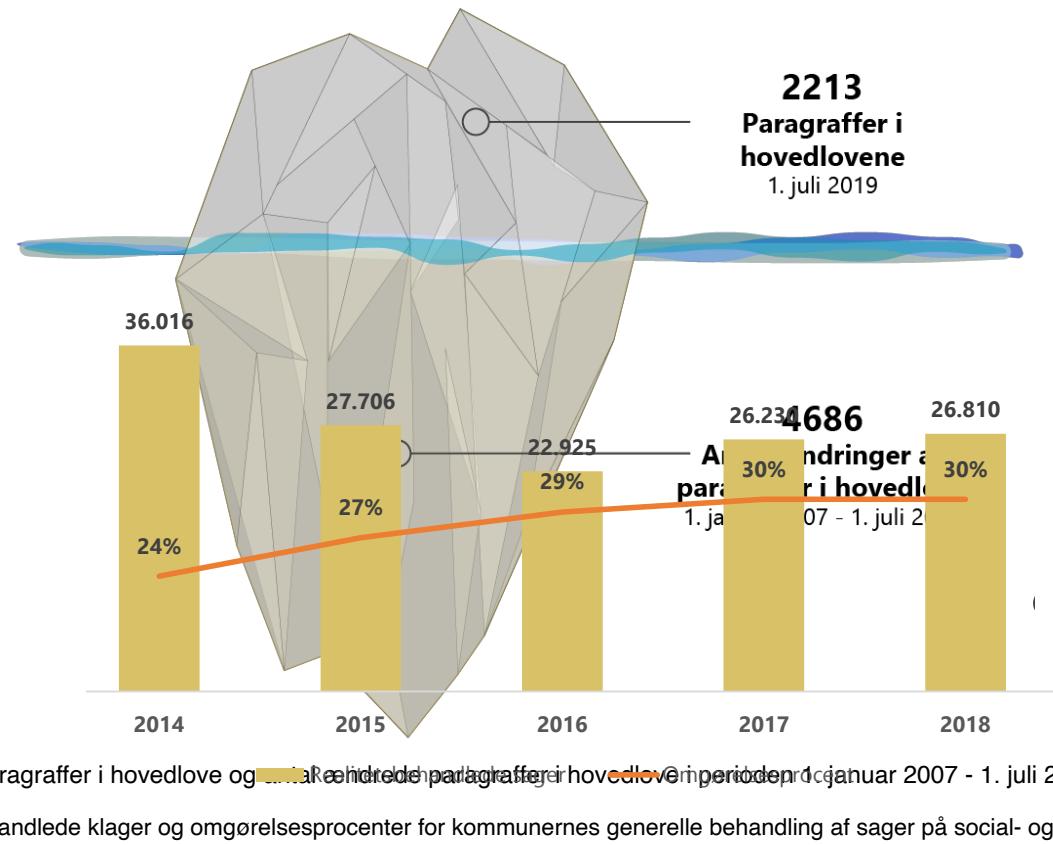
► LYT TIL ARTIKLEN 04:43

Da et bredt flertal i Folketinget i november 2016 indgik aftale om at opbygge et nyt system til at vurdere ejerboliger, udlejningsejendomme og erhvervsejendomme, blev der afsat knap 2,7 milliarder kroner fra 2017 til 2020 til at udvikle et nyt system, der skulle kunne vurdere ejendommene bedre og håndtere klagerne.

3 år senere har forsinkelser og fordyrelser fået denne regning til at stige til 4,7 milliarder kroner frem til 2021 med udsigt til, at regningen vil vokse yderligere i de kommende år.

Udskydelsen, der er den femte siden 2013, skete med den begrundelse, at Statens It-råd i august skrev til ministeriet, at det ville være »helt urealistisk« at fastholde den hidtidige tidsplan. Et af problemerne er, at staten skal overtage opkrævningen af grundskyld – skat på grundenes værdi – fra kommunerne, og håndtere en række komplicerede regler om rabatter, af grundskyld og særlige regler for pensionister.

Size, complexity and variability of compliance sources are challenging



”

Annual costs of compliance management in the Danish Financial Sector²:

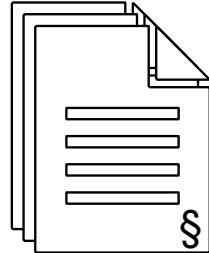
DKK 3.400.000.000

Globally, compliance costs is expected to triplicate by 2025³

2. Finans Denmark (2019) Øget compliance-indsats koster bankerne på indtjeningen. https://finansdanmark.dk/media/40183/analyse_oeget-compliance-indsats-koster-bankerne-paa-indtjeningen.pdf

3. Stamford Conn.: Gartner Predicts Legal Technology Budgets Will Increase Threecold By 2025 (2021). HTTPS://GTNR.IT/3QP2YSD

State of the practice



Laws



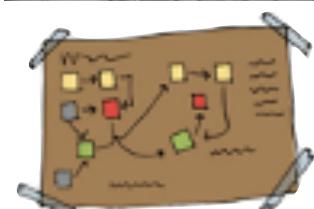
Interpret
(manual)



Inconsistent interpretations



Interpret
(manual)



Design
(manual)

```
    * Return the CPRNumber
    public String getCPRNumber() { return CPRNumber; }

    /**
     * @param CPRNumber the CPRNumber to set
     */
    @XmlElement
    public void setCPRNumber(String CPRNumber) {
        String oldCPRNumber = this.CPRNumber;
        propertyChangeSupport.firePropertyChange("PROP_CPRNUMBER", oldCPRNumber, CPRNumber);
        int CPRYear = Integer.parseInt(CPRNumber.substring(0, 2));
        int CPRMonth = Integer.parseInt(CPRNumber.substring(2, 4));
        int CPRDay = Integer.parseInt(CPRNumber.substring(4, 6));
        Calendar birthday = new GregorianCalendar(year:1900+CPRYear, CPRMonth, CPRDay);
        Calendar today = new GregorianCalendar();
        today.set(Calendar.Date());

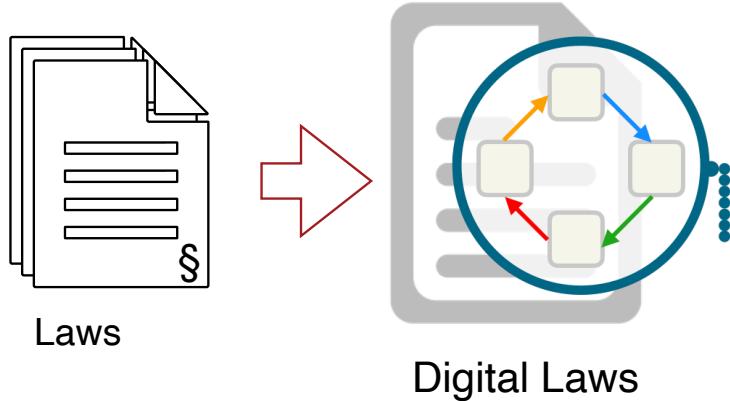
        int deltaYears = today.get(Calendar.YEAR) - birthday.get(Calendar.YEAR);
        int deltaMonths = today.get(Calendar.MONTH) - birthday.get(Calendar.MONTH);
        int deltaDays = today.get(Calendar.DAY_OF_MONTH) - birthday.get(Calendar.DAY_OF_MONTH);
        this.age = (deltaYears*12+deltaMonths+deltaDays)/360;
    }
```

Code (manual)

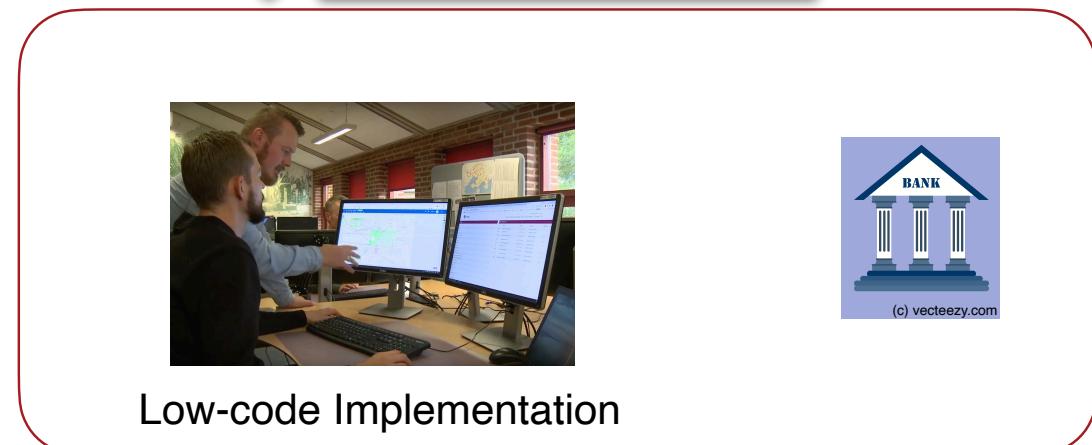


Organizations

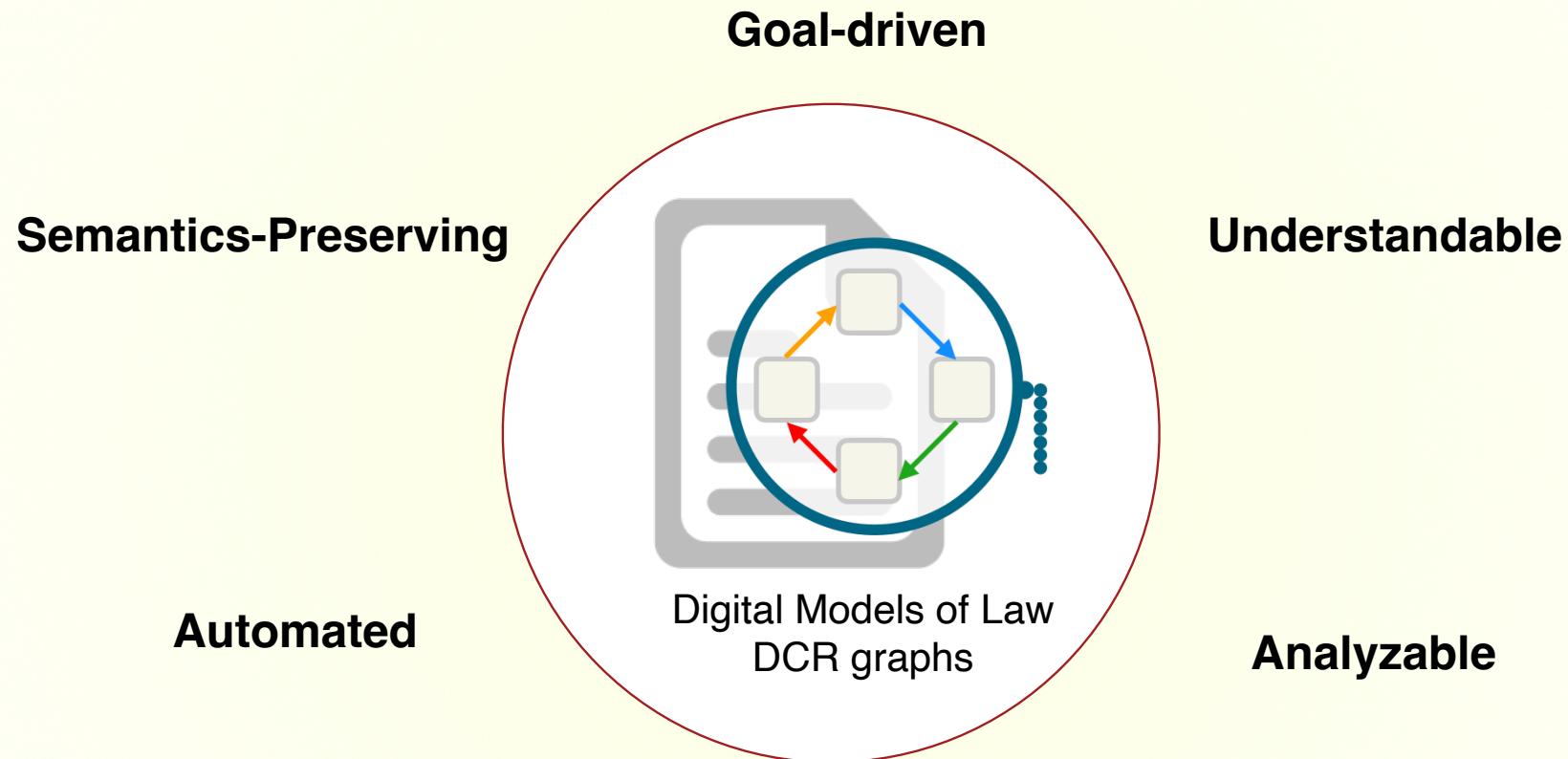
Our Approach



Consistent understanding



Benefits



Impact of a better legal design based on digital laws

Business	Legal Services	Justice/Legal System	Law Design & Education
<ul style="list-style-type: none">• Fair & Ethical Businesses• Lighter organizations• Visual regulations and regulation design• Automation Technology• Interfaces between humans and their rights• Verifiable and explainable compliance checking	<ul style="list-style-type: none">• Making legal services more accessible and understandable• Traditional legal system vs legal services/law	<ul style="list-style-type: none">• Human-centered justice• Automate justice• Making law/justice understandable• Legal system design• Legal processes made visible/understandable/verifiable/accessible• Make legal processes plain	<ul style="list-style-type: none">• Legal design thinking and standards• Connecting cross-disciplinary collaboration• Legal literacy• Help designers understand the law, and be able to design better laws• Legal reasoning

SOME USE CASES



Social Service Law
Syddjurs Kommune

Building Regulations
Københavns Kommune and
Comune di Genova (Italy)



COVID Guidelines
Copenhagen University



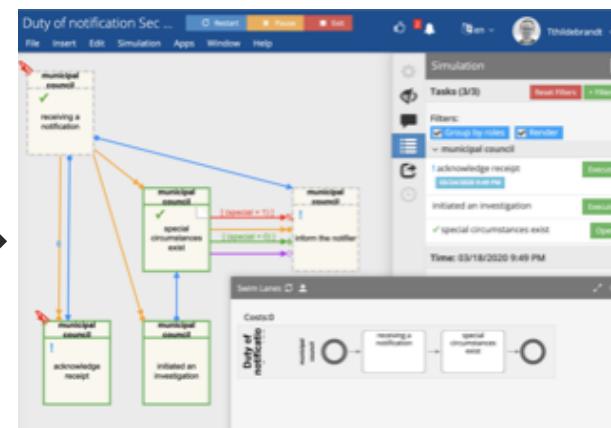
Green Transition Legislation
Rinkøbing-Skjern Kommune

Digitalization of the “Consolidation Act on Social Services” @ Syddjurs Municipality

Challenge:

Increase the ability of case workers and lawyers to digitalise and adapt changing legal regulations and best practice workflows while reducing the number of complaints by citizens to Ankestyrelsen that leads to a change of decision.

The screenshot shows a search interface for the Serviceloven. A search term 'receiving a notification' has been entered. The results list several articles, with the first one highlighted in blue: '155 b-(1) Within six (6) business days after receiving a notification under sections 152-154 above, the municipal council shall acknowledge receipt of the notification to the notifier.' Below the search bar, there are filter options and a help section.



The screenshot shows a task list in the DCR Open Case Manager. The case is titled 'MUS 2018 Jon'. The tasks listed are: 'Afhøde udviklingsamtale' (Deadline: 28.09.2018, Morten, checked), 'Forberedelse' (Deadline: 28.09.2018, Morten, checked), 'Forberedelse' (Deadline: 28.09.2018, Morten, checked), 'Inviter medarbejdere i Outlook' (Deadline: 28.09.2018, Morten, checked), and 'Lav samfale skema' (Deadline: 28.09.2018, Morten, checked). The interface includes navigation tabs for PLANLÆGNING, FORBEREDELSE, SAMTALE, UDVIKLINGSAFTALE, OPPROLNING, and AFSLUTTET.

1. Law input: Serviceloven

2. Refine and simulate DCR models

3. Execute in DCR Open Case Manager

The Tour

1

- Digital Models of law with DCR graphs
- Simulation, Validation, Verification

2

- Automating legal understanding via natural language processing

Work+shop

<https://www.dcrgraphs.net>

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Objective

To generate a digital model of a law, preserving its semantics

Executive Order no. 1053 of 8 September 2015 (Current)
Print-out date: 28 October 2015
Ministry: The Danish Ministry of Social Affairs and the Interior File number: Ministry of Social Affairs and the Interior, file no. 2015-4958
Later amendments to the regulation ACT No. 495 of 21 May 2013 ACT No. 722 of 25 June 2014

Consolidation Act on Social Services

An Act to consolidate the Act on Social Services, cf. Consolidation Act No. 150 of 16 February 2015, as amended by section 3 of Act No. 527 of 29 April 2015, section 1 of Act No. 529 of 29 April 2015, section 2 of Act No. 530 of 29 April 2015, section 1 of Act No. 649 of 18 May 2015 and Act No. 650 of 18 May 2015.

The amendment under section 1(ii) of Act No. 495 of 21 May 2013 on Amendment of Act on Social Services and Act on Legal Protection and Administration in Social Matters (Crime preventive social initiatives) has not been incorporated into this Consolidation Act since the Minister for Social Affairs and the Interior shall determine the effective date of this amendment, cf. section 3(2) of Act No. 495 of 21 May 2013.

The amendment under section 1(vi) of Act No. 722 of 25 June 2014 on Amendment of Act on Social Services, Act on Legal Protection and Administration in Social Matters and various other acts (Follow-up on evaluation of the Local Government Reform regarding the most highly specialised social area and the most highly specialised educational, etc.) has not been incorporated into this Consolidation Act since the Minister for Social Affairs and the Interior shall determine the effective date of this amendment, cf. section 12(3) of Act No. 722 of 25 June 2014.

Title I Introduction

Part 1

Purposes and scope

1.-**(I)** The objectives of this Act are (i) to offer advice and support so as to prevent social problems, (ii) to offer a number of general services designed to serve as preventive measures at the same time and (iii) to satisfy needs resulting from impaired physical or mental function or special social problems.

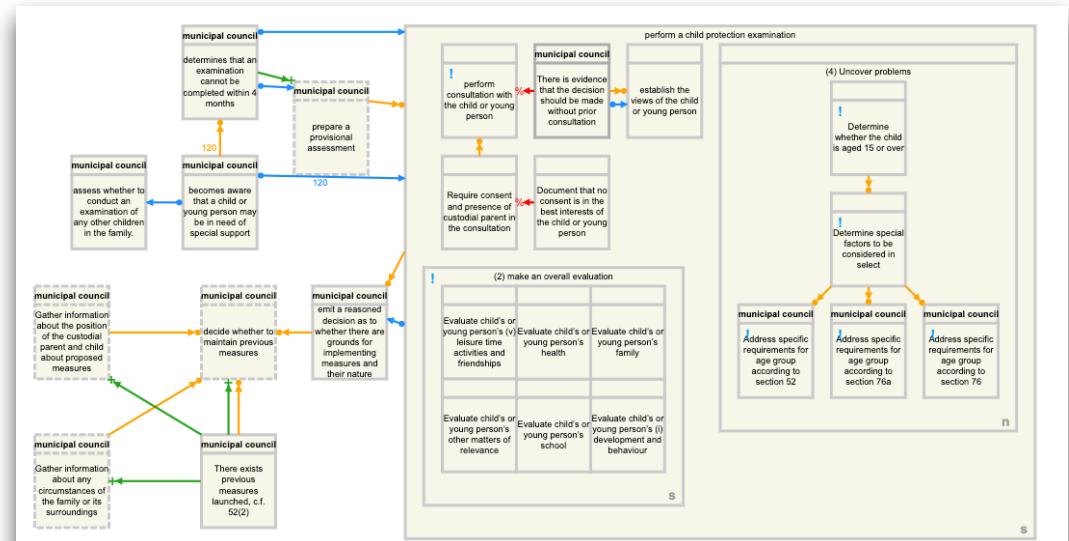
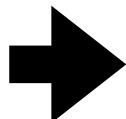
(2) The purpose of the assistance provided under this Act is to improve the capability of the individual recipient to be self-reliant, or to facilitate his/her daily life and enhance the quality of life.

(3) The assistance provided under this Act is based on the individual recipient's personal responsibility and the responsibility for his/her family. The assistance shall be provided on the basis of a specific individual assessment of the recipient's particular needs and circumstances and in consultation with the individual recipient. Any decision under the Act shall be made on the basis of professional and financial considerations.

2.-**(I)** Any person who is lawfully staying in Denmark is entitled to assistance under this Act.

(2) The Minister for Social Affairs and the Interior shall lay down rules specifying any assistance that may continue to be provided to a person residing outside Denmark on a temporary basis and the conditions for the provision of such assistance.

(3) By agreement with other states or international organisations, the municipal council may grant assistance for long-term care or treatment etc. in Denmark to a person who has a special connection to Denmark, but who is not a Danish resident at the time of application. The same shall apply to the care or treatment etc. of a Danish resident taking up residence in another country to which he/she has a special connection.



Exercise: Understanding §42 in the Service Law

1. Get a copy of the law

Latest version

<https://www.retsinformation.dk/eli/ita/2018/1114>, or

Official Translation (2015)

<http://english.sm.dk/media/14900/consolidation-act-on-social-services.pdf>, or

Printed version (in the back of the hand-ins)

2. Discuss in groups the cases for Alice, Bob & Camilla, and David
3. Write down the necessary considerations to decide the outcome of one of the cases according to §42 (1)-(2), and your expected outcome



Social Service Law
Syddjurs Kommune

Running Example

<http://english.sm.dk/media/14900/consolidation-act-on-social-services.pdf>

Loss of earnings

- 42.–(1) The municipal council shall pay compensation for loss of earnings to persons maintaining a child under 18 in the home whose physical or mental function is substantially and permanently impaired, or who is suffering from serious, chronic or long-term illness. Compensation shall be subject to the condition that the child is cared for at home as a necessary consequence of the impaired function, and that it is most expedient for the mother or father to care for the child.
- (2) The requirement in subsection (1) above that the child shall be cared for at home shall not apply to any child mentioned in subsection (1) who has been placed in care under section 52(3)(vii) in connection with the child's hospital visit. It is a condition that the presence of the mother or father at the hospital is a necessary consequence of the child's functional impairment and that such presence is most expedient for the child.
- (3) The compensation shall be fixed on the basis of the previous gross income, always provided that the maximum amount of compensation shall be DKK 27,500 a month. The maximum amount shall be reduced at the ratio of hours compensated for loss of earnings to the total number of working hours. A pension scheme contribution amounting to 10 per cent of the gross compensation shall be calculated. However, the contribution shall not exceed an amount equivalent to the contribution previously paid by the employer. Pursuant to the Act on the Labour Market Supplementary Pension Scheme, the municipal council shall pay Labour Market Supplementary Pension ("ATP") contributions in respect of the compensation for loss of earnings. The recipient shall pay one third of the ATP contributions, and the municipal council shall pay two thirds.
- (4) The Minister for Social Affairs and the Interior shall lay down rules governing the calculation and adjustment of loss of earnings under subsection (3) hereof, including the calculation and payment of pension contributions and, on the recommendation of the Labour Market Supplementary Pension Fund, rules governing payment of ATP contributions.

Exercise 1

Discuss in your group the following questions

Write the set of decisions that need to be taken, and your expected outcome

- Alice is the mother of a 2 year-old child, who has a speech impairment. The nursery where the child goes says that it is likely a case of mild autism, but that the nursery can receive the child during daytime. Alice is asking for support for compensation for loss of earnings. What should she document to support her case?
- Bob and Camilla are the parents of a baby whose lungs are in poor condition. Doctors say that the child might get better if he has continuous respiratory therapy, but recommends that the therapy is taken in the hospital. The developmental psychologist advice that proximity to the parents might reduce the stress of the therapy. Both parents are fully employed. What aspects should the municipality assess in this case, and what should they decide?
- David is a divorced father and has a kid with down syndrome from his last relationship. He does not have custody of the child, but sees him from time to time. David asks for compensation for loss of earnings. Can he receive support?

Considerations and possible outcome for each case:

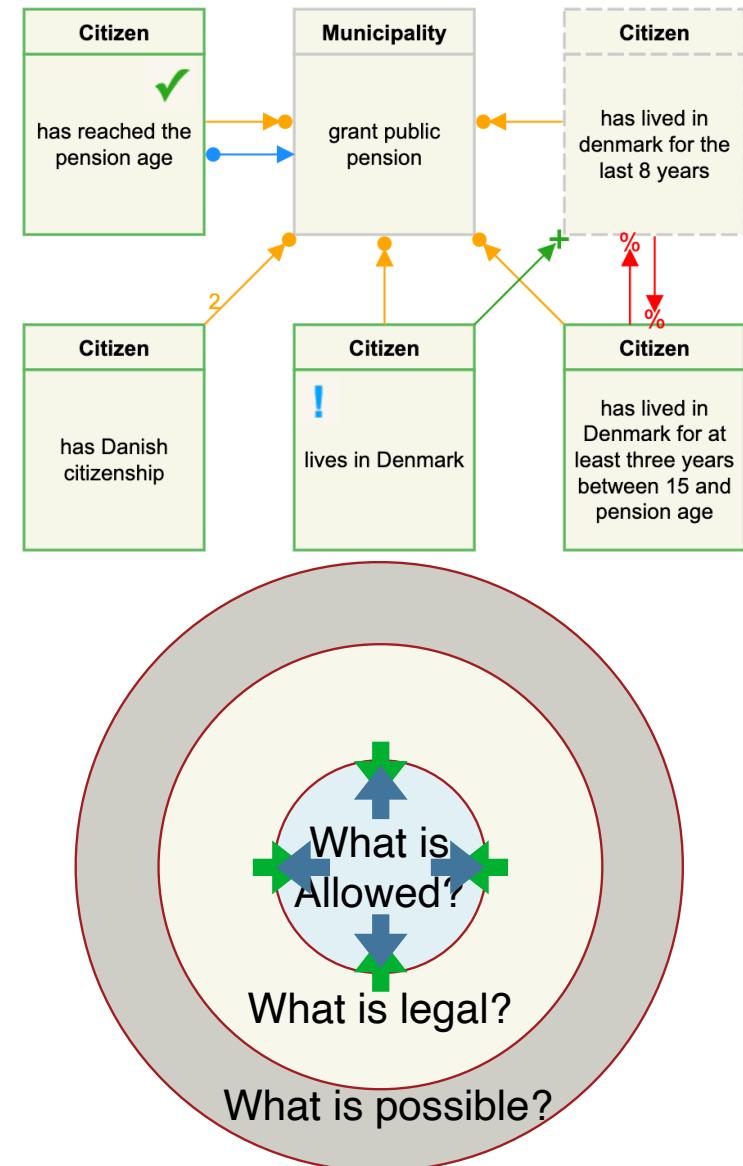
Alice

Bob & Camilla

David

Normative Models via DCR graphs

- Norms define permissions, obligations, violations, and relations between articles/other laws
- **Declarative Process Models** prescribe the rules to be followed, rather than imposing a control flow
- Defines activities, roles, and behavioural constraints:
 - Conditions
 - Responses
 - Dynamic inclusion/exclusion



Mapping Technical Sections

Event Annotations

- One of the critical parts of law annotation is the identification of situations, decisions or course of actions that are legally binding. DCR encloses all these information in what we simply call “events” or “activities”

- Some examples of correct events are:
 - *assist in the provision of safe and appropriate technical aids*
 - *be eligible for accommodation in a nursing home under subsection (1)*
 - *establish services and facilities falling within subsections (1), (3) and (4) hereof*
 - *operate the facilities referred to in section 67(1) subject to agreement under section 194(2)*
 - *provide information about services and facilities covered by section 5 above to the Social Services Gateway, cf. section 14 below*
 - *has a special connection to Denmark*
 - *is not a Danish resident at the time of application*

Example

The Minister for Social Affairs and the Interior shall collect and communicate information about municipal, regional and private services and facilities covered by section 4 of the Act on Social Supervision

Mapping Technical Sections

Role annotations

- In order to preserve accountability, each event needs to be associated with a role. Some examples of legal roles include:

- *person*
- *Minister for Social Affairs and the Interior*
- *The Minister for Children, Education and Gender Equality*
- *municipal council*
- *regional council*
- *Danish resident*

Example

14.–(1) The **Minister for Social Affairs and the Interior** shall collect and communicate information about **municipal, regional and private services and facilities** covered by section 4 of the Act on Social Supervision



The action is applied to this subject, thus not a role

Mapping Relations

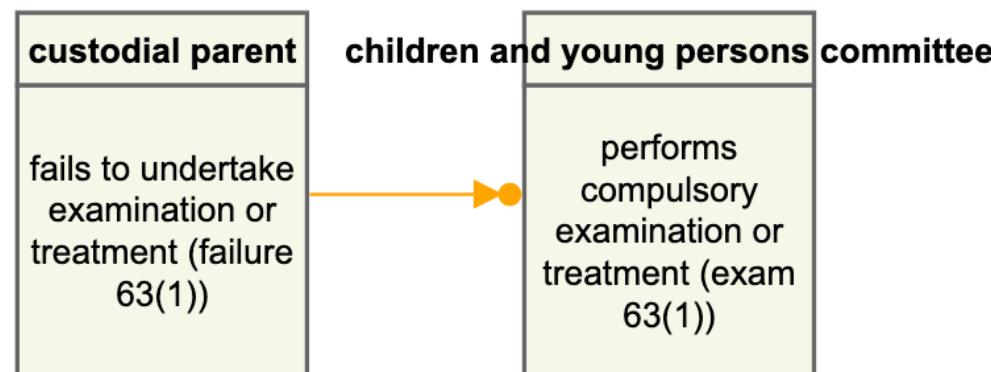
The semantics in the law

- **Obligation** A situation, an act, or a course of action(s) to which a bearer is legally bound, and if it is not achieved or performed results in a violation.
E.g. show your documents upon police request
- **Prohibition** A situation, an act, or a course of action(s) which a bearer should avoid, and if it is achieved results in a violation.
E.g. Get unemployment benefits without documenting unemployment
- **Permission/Right** Something is permitted if the obligation or the prohibition to the contrary does not hold.
E.g. Appeal a case outcome
- **Defeasible conditions** They enable us to describe the course of action resulting from exceptional cases (contrary to duty) by modifying (remove or include from the context) obligations, permissions and prohibitions.
E.g COVID Vaccinated Danish nationals can enter denmark unless they have stayed in areas of concern within the past 10 days.

Annotating Rules

Sentences define relations between events

- **Condition** A sentence that denotes a condition relation requires that each of the clauses is fulfilled for the list of consequences to be allowed. This is akin of granting a set of rights. Rights are not obligations, and they might be enforced or not.

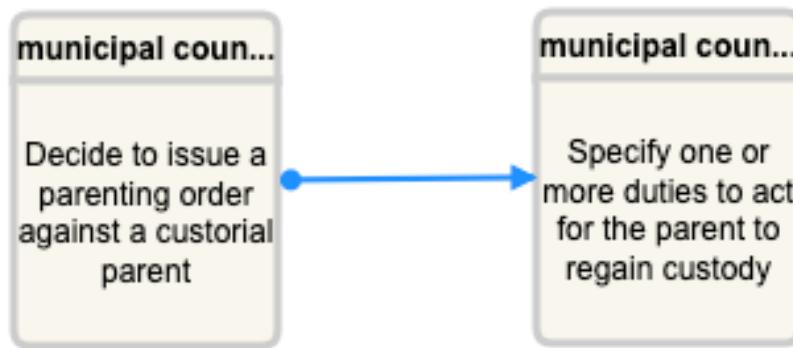


If the custodial parent fails to have a child or young person examined or treated for a life-threatening disease or a disease involving the risk of substantial and permanent impairment of function, the children and young persons committee may decide to undertake such examination or treatment.

Annotating Rules

Sentences define relations between events

- **Response** A sentence that denotes a response relation requires that any of the clauses generate a list of obligations to be fulfilled. Comparing to rights, all obligations must be fulfilled in a case, so the case cannot be closed if they are not executed.



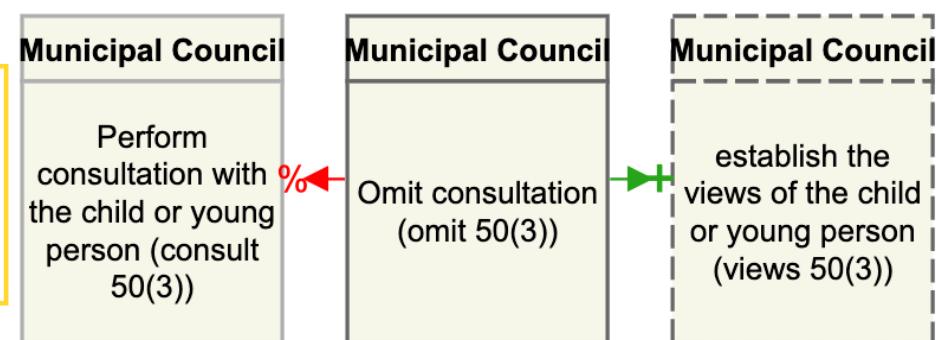
If the municipal council decides to issue a parenting order against a custodial parent, then it shall specify one or more duties to act for the parent to regain custody

Annotating Rules

Sentences define relations between events

- **Exclusion** A sentence that denotes an exclusion relation requires that any of the clauses inhibits the consequences from happening. This could be because the consequences are no longer necessary in the processing of the case.
- **Inclusion** A sentence that denotes an inclusion relation requires that any of the clauses makes available the list of consequences. This could be, for instance, when allowing new alternative paths for a case, or when adding optional events that can happen in a case.

The consultation may be dispensed with if factors such as the maturity of the child or young person or the nature of the case strongly suggests that the decision should be made without prior consultation. If the consultation cannot be conducted, steps shall be taken to establish the views of the child or young person.



Exercise 2

Exercise

Identify the events, roles and relations

- 42.–(1) The municipal council shall pay compensation for loss of earnings to persons maintaining a child under 18 in the home whose physical or mental function is substantially and permanently impaired, or who is suffering from serious, chronic or long-term illness. Compensation shall be subject to the condition that the child is cared for at home as a necessary consequence of the impaired function, and that it is most expedient for the mother or father to care for the child.
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Annotations for Section 42

Roles

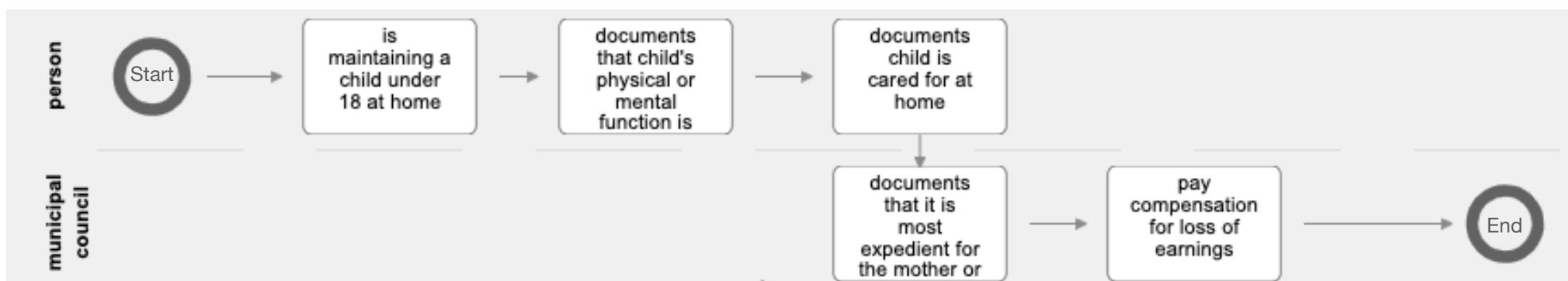
Legal Events

Relations

Validation

Can we test a law?

- A simulation allows us to define particular sequence (traces) of events that our model should accept, or which ones should rule out
- Example: Compensation of benefits given to families performing home care



Exercise 3

Define one trace for each of the cases for Alice, Bob & Camilla, and David

Alice

-

Bob & Camilla

-

David

-

The Tour

1

- Digital Models of law with DCR graphs
- Simulation, Validation, Verification

2

- Automating legal understanding via natural language processing

Work+shop

<https://www.dcrgraphs.net>

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To conclude

Take home message

Software systems have the social responsibility to abide societal laws

The future of work has the opportunity to render the complex decision processes in laws understandable, explainable, verifiable, and prone to robotic support, creating new businesses & adding transparency and accountability

To realize these promises, sound methods to understand, process, check and visualize (parts of) need to continue maturing

An interdisciplinary approach combining formal methods, data science, ML, NLP, legal theory and HCI needs to be in place to support citizens and organizations understand and improve their compliance needs



Thank you!

Any questions?

UNIVERSITY OF COPENHAGEN

