

FORENSIC SCIENCE  
ERROR MANAGEMENT

INTERNATIONAL  
FORENSICS SYMPOSIUM

July 24-27, 2017 @NIST, Gaithersburg, MD



# Proposal for a methodology to manage contextual information in forensic handwriting examination based on digitized documents

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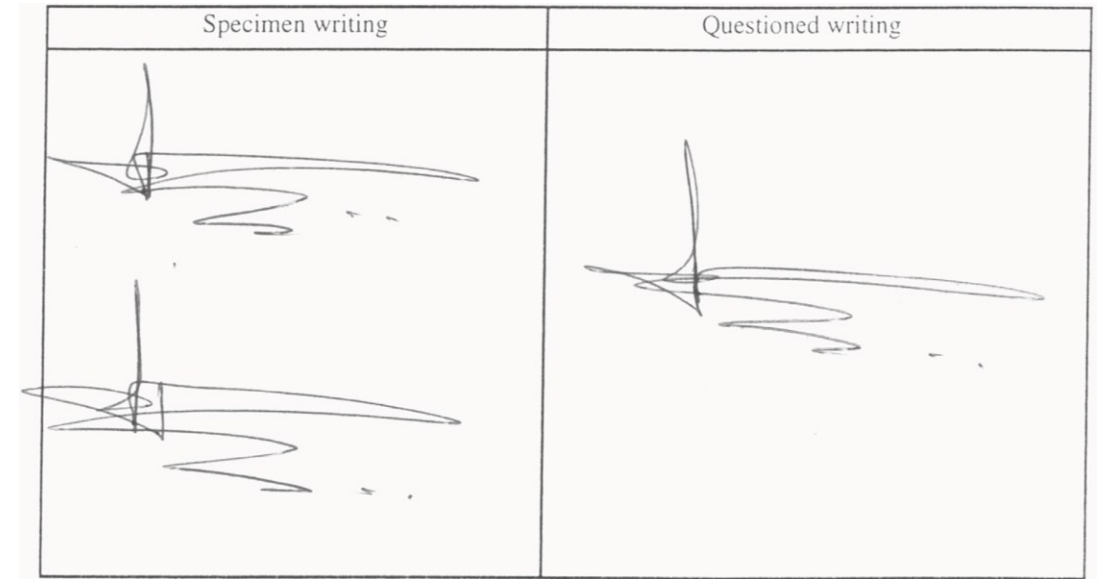
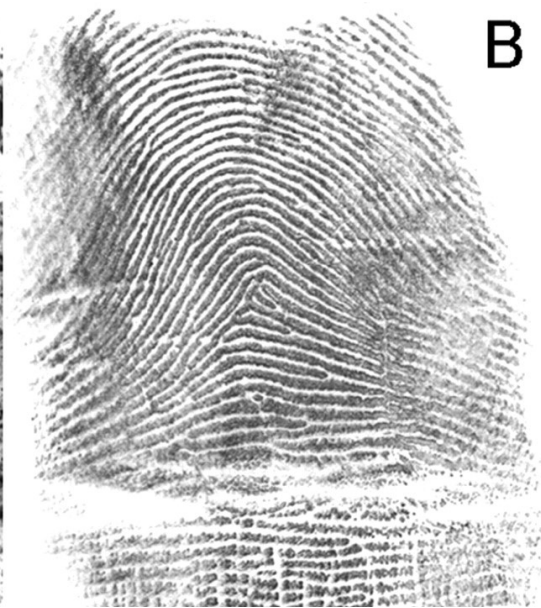
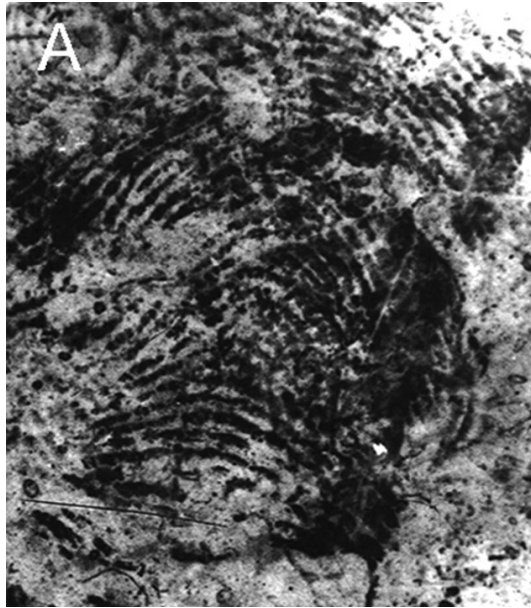
PAULO AKIRA KUNII

BRAZILIAN FEDERAL POLICE

# Summary

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1. Context Information Management
2. The problem
3. Forensic Handwriting Examination with digitized documents
  1. Image acquisition
  2. Image editing (CIM)
  3. Submission
  4. Image examination
  5. Report
4. Conclusion
  - Pros and cons



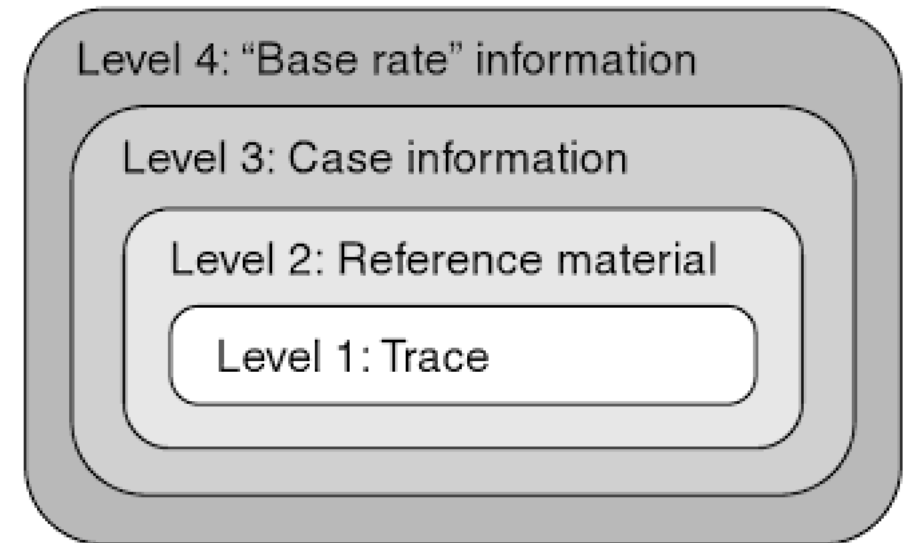
# 1. Context Information Management

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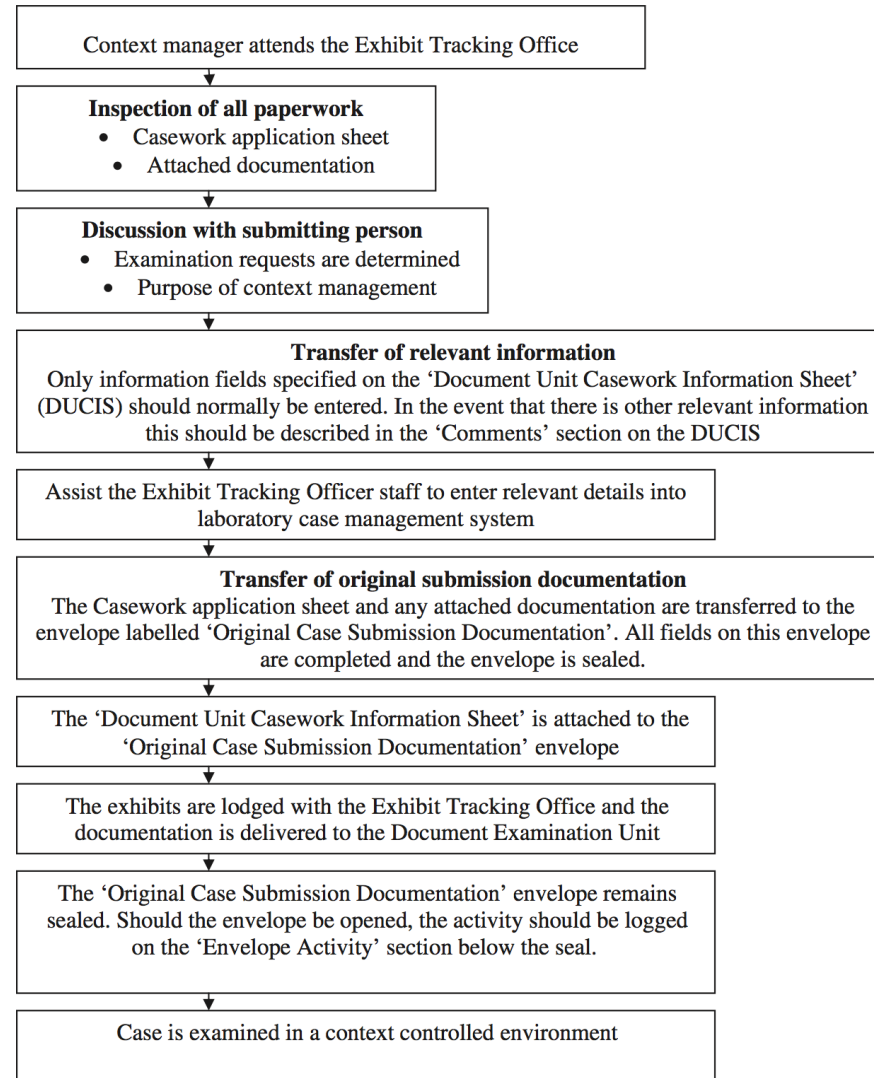
- General problem in Forensic Science: identification of the source of the evidence
- Comparison of physical features => objective methods, subjective judgements
- Contextual information => cognitive bias
- Empirical evidence of *cognitive contamination*
- Strategies: sequential unmasking, evidence line-up, **context information management**



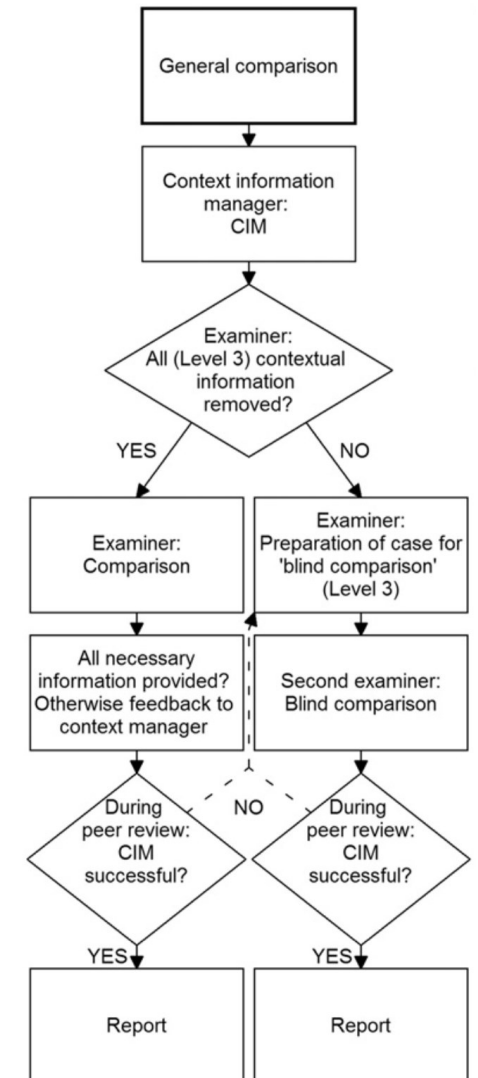
Levels of contextual information  
(Stoel et al, 2015)

# 1. Context Information Management

- A **context manager** filters out task-irrelevant information, before submitting case to **examiner**
- Fixed or rotative role
- Cognitive contamination minimized
- @ Victoria Police Forensic Services Department
- @ Netherlands Forensic Institute
- Mainly level 3 contextual information



VPFSD (Found & Ganas, 2012)



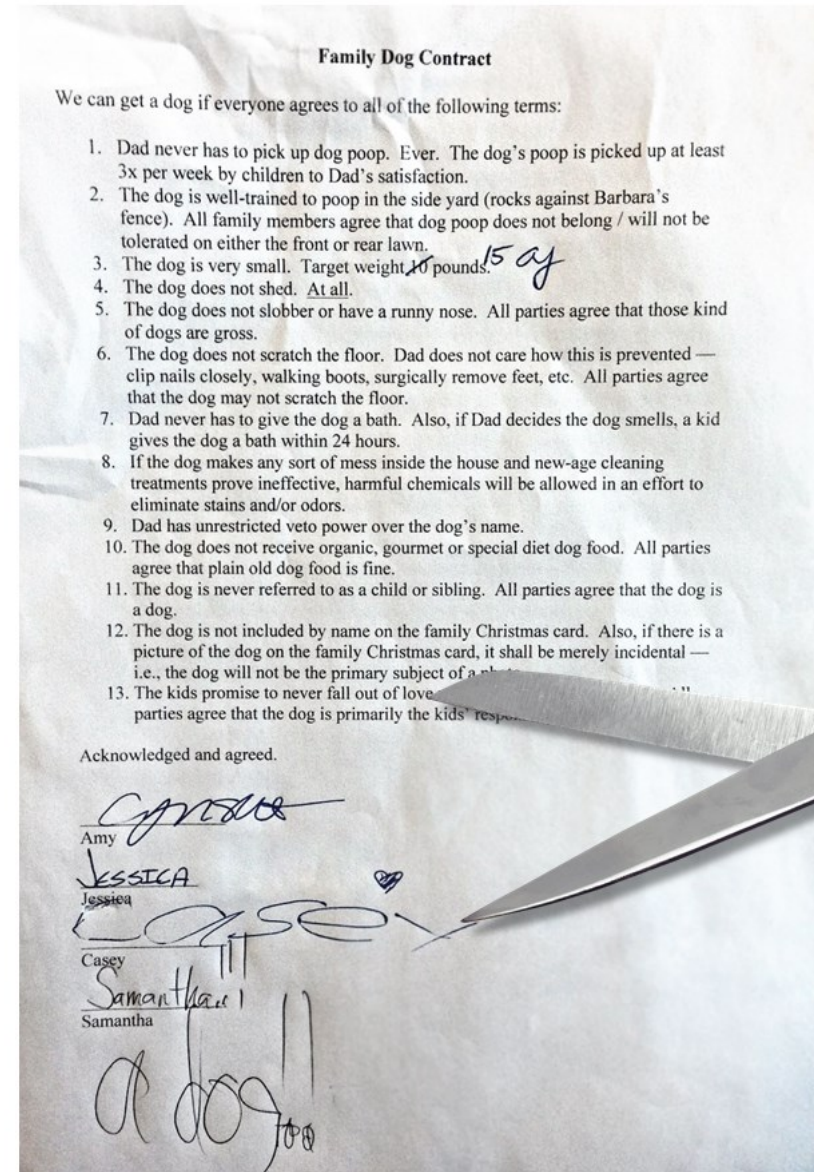
NFI (Mattijssen et al, 2015)

Img. 4: Found B, Ganas J. The management of domain irrelevant context information in forensic handwriting examination casework. *Sci Justice*. 2013 Jun;53(2):154-8.

Img. 5: Mattijssen, E.J.A.T. et al. Implementing context information management in forensic casework: Minimizing contextual bias in firearms examination. *Sci Justice*. 2016 Mar;56(2):113-22.

## 2. The problem

- VPFSD and NFI: context information management mostly focused on level 3
- Documents and handwritings: context information of levels 1, 2
- FHE: *bias danger zone*
- How to hide task-irrelevant handwritings and printings that might bias the examiner?



# 3. FHE with digitized documents

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Image acquisition



Image editing (CIM)



Submission




Image examination

# 3.1 Image acquisition

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- Relevant details for FHE must be visible:
  - Elements of style: dimensions, spacing etc.
  - Elements of execution: pressure, stroke quality etc.
  - Elements of writing instrument: burr striations etc.
- Techniques and equipment:
  - Normal / oblique / transmitted / coaxial lighting
  - Visible / UV / IR
  - Scanning / macro photography / VSC / ESDA
  - Copy stand, scales



Context manager must be a  
Forensic Handwriting  
Examiner too!



Data Base:

01 / 04 / 05

15/12/2008; 15/12/2009; 15/12/2010  
15/12/2001

16 P-M



**CONTRATO**

P-1169/00-M0-

**1 - IDENTIFICAÇÃO DAS PARTES CONTRATANTES**

Contratante:	CONSÓRCIO INTEGRADORA-		
Endereço:	Rua Embaixador Pedro	Estado:	São Paulo
Cidade:	Cubatão	E-Mail:	
Fax:		I. Estadual:	
CNPJ/MF:		I. Municipal:	
CEP:	11510-090		
Fone:			
Contratada:	EMPREITEIRA		
Endereço:	Rua Doutor Rafael c	Estado:	SP
Cidade:	São Paulo	E-Mail:	
Fax:		I. Estadual:	
CNPJ/MF:		I. Municipal:	
Cep:			
Fone:			

**2 - OBJETO DO CONTRATO**

Apoio à Contratante na prestação de serviços de coordenação na análise de documentação de proponentes no contrato

Este contrato substitui integralmente o Contrato P-1169/00-M0-

Anexos: Proposta nº  Proposta  Carta  Outros  Não há

**3 - PRAZOS**

Prazo de Execução: 26 meses Início: 01/02/2010 Término: 30/03/2012

Prorrogações: Vide condições contratuais gerais "Verso"

Penalidades: Vide condições contratuais gerais "Verso"

**4 - REMUNERAÇÃO**

Valor do Contrato: R\$ 4.810.500,00 Global  Estimado

Forma de Pagamento: Conforme Clausulas 5.2.1 e 5.2.2 deste instrumento.

Valor Quitado até 30/06/2011 = R\$1.824.200,00

Valor a pagar: R\$2.886.300,00 em 9 parcelas mensais fixas a partir de Julho 2011

Reajuste: Não há

Serviços Vinculados ao Centro de Custo: 1169/00 Cliente: Petrobras

Faturamento Contra Cliente: Sim  Não  Forma:

**5 - CONDIÇÕES CONTRATUAIS**

5.1 - CONDIÇÕES CONTRATUAIS GERAIS (Vide Verso)

5.2 - CONDIÇÕES CONTRATUAIS ESPECÍFICAS (Vide Verso)

5.3 - ESCOPO DOS SERVIÇOS (Vide Verso)

5.4 - LOCAL PARA PAGAMENTO (Vide Verso)

**6 - RESPONSÁVEL PELA CONTRATATAÇÃO**

ACIMA DE R\$ 500.000,00	R. EGV	R. INFLAN	R. NM	COMTE EGV	COMTE INFLAN	COMTE NM	JURIDICO
ATE R\$ 500.000,00	R. EGV	R. INFLAN	R. NM				JURIDICO

APOR SIGLA DO ORGAO/ROBINA

**8 - ASSINATURAS**

Barueri, 01 de Fevereiro de 2010

Contratada: EMPREITEIRA

Contratante: CONSÓRCIO INTEGRADORA-U



Contratante: CONSÓRCIO INTEGRADORA-U

1ª via - Contratante 2ª via - Contratado

Contratante: CONSÓRCIO INTEGRADORA-U

1ª via - Contratante 2ª via - Contratado

mais perfeita saúde. incl

zelosos pais: Inaceima

Quedito que em fevereiro

## 3.2 Image editing (CIM)

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- Preparation of images, hiding task-irrelevant handwritings / printings
  - Obfuscation
  - Cropping
- Small adjustments might also be made by Context Manager
  - Brightness, contrast, white balance
- Software
  - Many available for these simple tasks
  - I recommend using GIMP



Opções de ferramentas

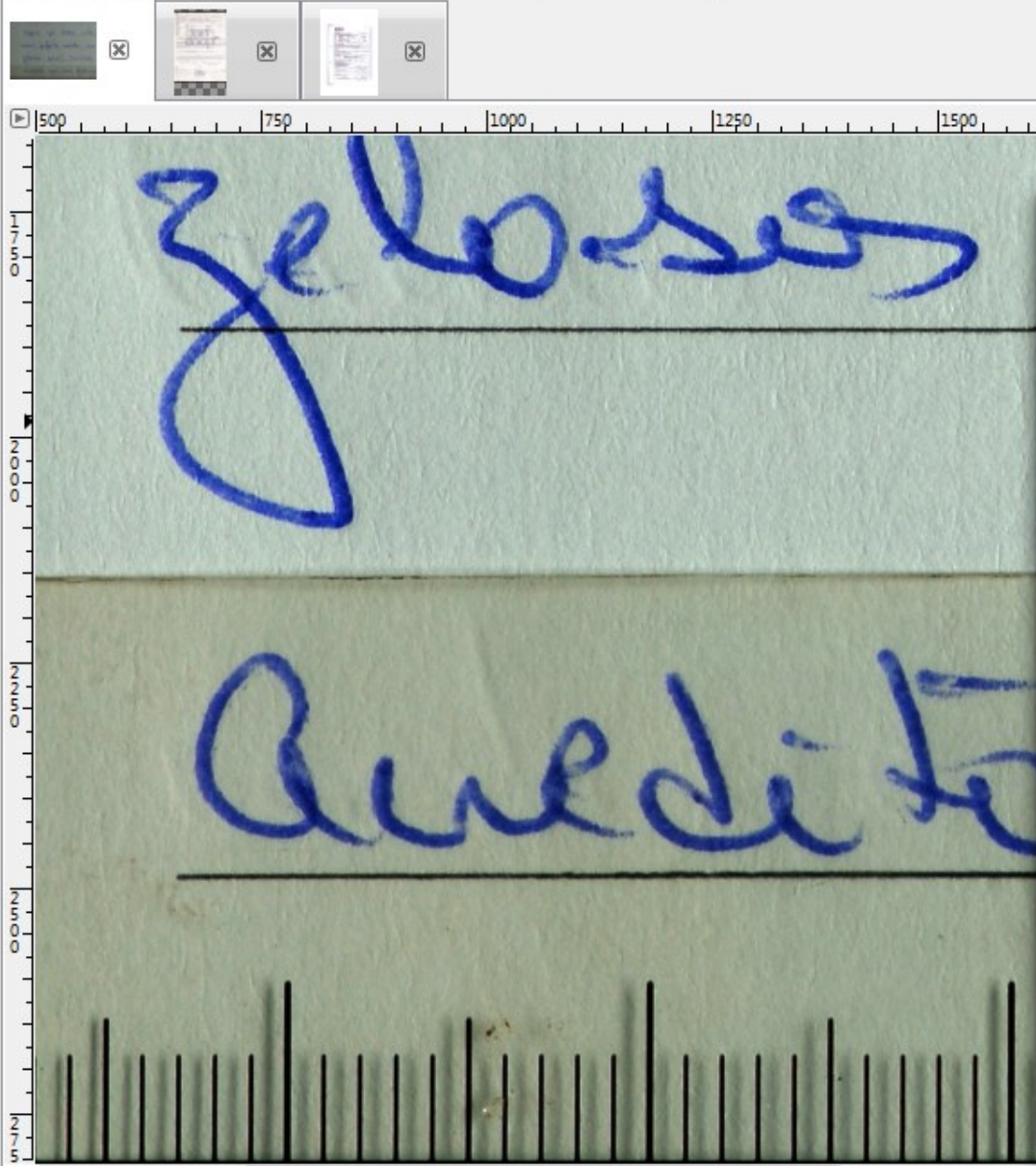
Níveis

Escala do histograma

- Histograma linear
- Histograma logarítmico

Amostra da média

Raio: 3



Níveis

**Ajustar níveis de cor**

cópia de DSC\_0645.JPG #1-21 ([DSC\_0645] (importada))

Armazenadas: [dropdown] + [dropdown]

Canal: Valor [dropdown] [Reinicializar Canal]

Níveis de entrada

14 1,00 151

Níveis de saída

0 255

Todos os canais

[Automático] [dropdown] [dropdown] [dropdown]

[dropdown] Editar estas configurações como curvas

Pré-visualização

Ajuda Restaurar OK Cancelar

Modo: Normal

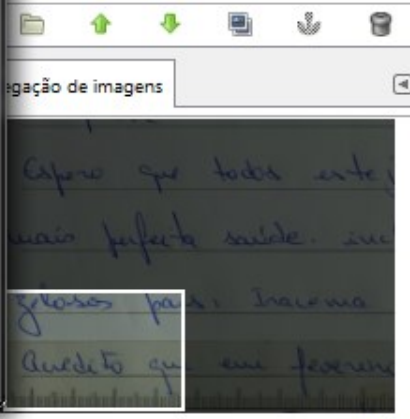
Opacidade: 100,0

Travar: [checkbox] [checkbox]

cópia de DSC\_0645.JPG

cópia de DSC\_0645.JPG #1

DSC\_0645.JPG





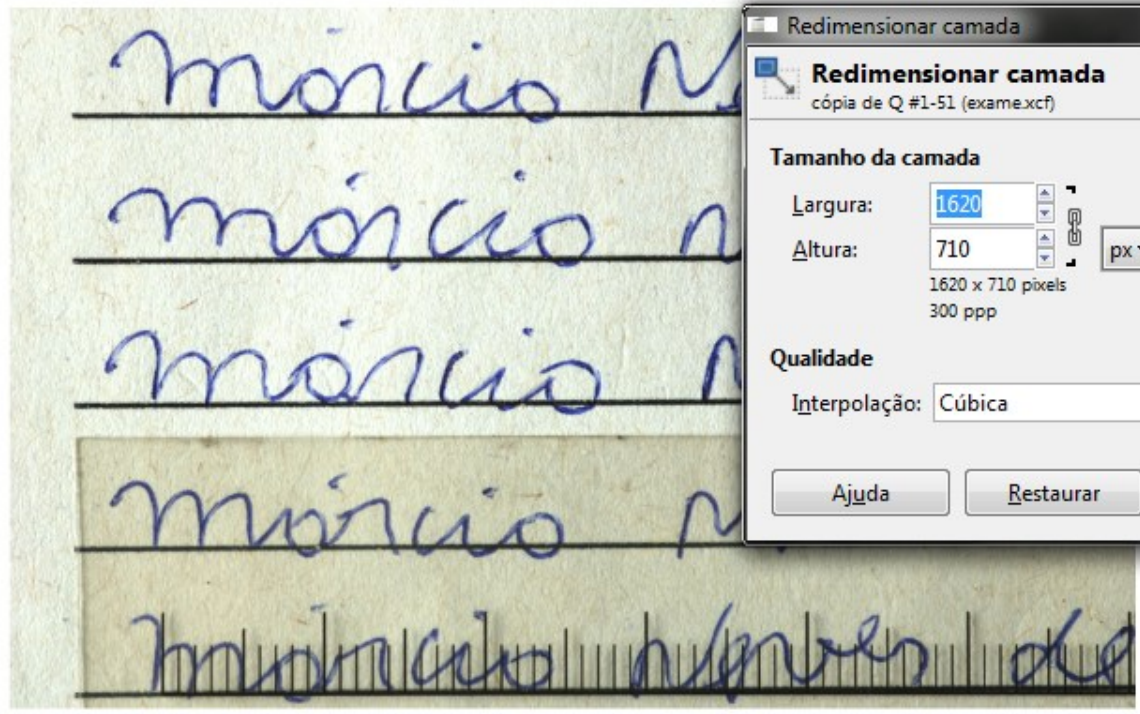
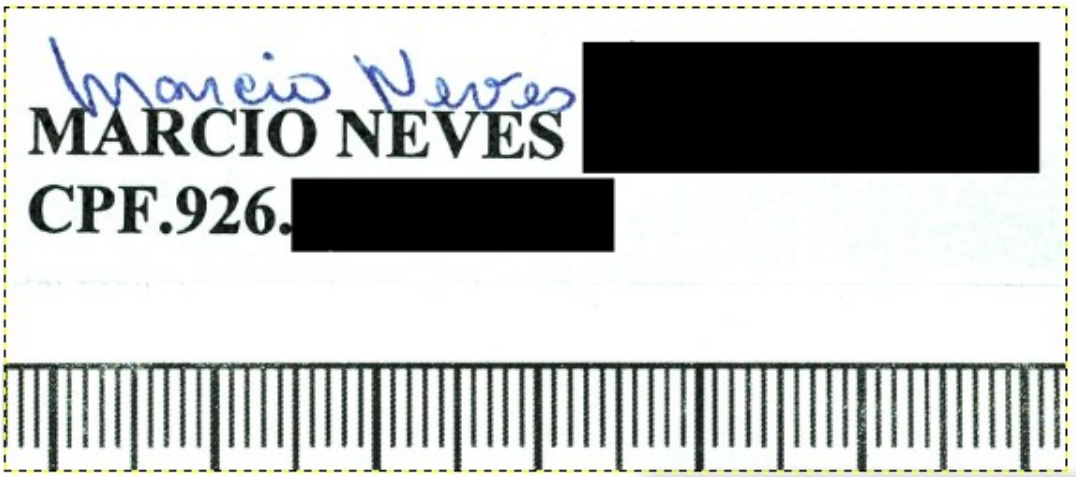
Opções de ferramentas

Mover

Mover:

Modo da ferramenta (Shift)

- Pegue uma camada ou guia
- Mover a camada atual



Redimensionar camada

Redimensionar camada  
cópia de Q #1-51 (exame.xcf)

Tamanho da camada

Largura: 1620

Altura: 710

1620 x 710 pixels  
300 ppp

px

Qualidade

Interpolação: Cúbica

Ajuda Restaurar Redimensionar Cancelar

Modo: Normal

Opacidade 100,0

Travar:

- DSC\_1264.JPG
- cópia de Q
- cópia de DSC\_1264
- cópia de P
- cópia de Q #1
- P
- Q
- DSC\_5137.JPG
- Camada

Navegação de imagens

35%

# 3.3 Submission

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- Submission of files from the context manager to the examiner:
  - Shared folders (intranet)
  - Cloud storage
  - Laboratory Information Management System (LIMS)
- Questioned handwritings and writing standards must be clearly identified
  - e.g., folder structure and filenames (e.g. “*Q\doc\_1\page\_2\img\_1.jpg*”)
- And the form with relevant information about the case
  - Dates associated with handwritings
  - Conditions that may have affected handwriting, if known (illness, injuries etc.)



## 3.4 Image examination

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- Examiner must be able to perform basic editions to carry out the examination
  - Brightness, contrast, white balance
  - Rotation, resizing
- Simple **image viewer** with basic editing options is OK
  - Examples: IrfanView, paint.net, Shotwell (Linux) etc.
- **Image editing** software is recommended
  - Examples: GIMP, Adobe Photoshop



Opções de ferramentas

Mover  
Mover: [ícone] [ícone] [ícone]  
Modo da ferramenta (Shift)  
 Pegue uma camada ou guia  
 Mover a camada atual

e maior justiça, que  
saber. Muitos homens  
diferente, alguns acham  
injusto. E que ao se  
e paixões que altera  
e determina estes dire  
natural.

O critério da verdade  
desejar para si o  
A primeira obrigação  
dos seus semelhantes.  
reitos, procederá se  
terais são os mes  
de até o de posição

em Londres vai bem  
ena e Berlim está cal  
esta viagem para sua  
peramos boas notícias

Paulo e chegarão  
27 de Novembro  
deverem ser endere  
Dragalzeu, 3580

Modo: Multiplicar  
Opacidade 100,0  
Travar: [ícone] [ícone]  
Camada #3  
José - natural  
José - colhido  
Camada #2  
Elisa - colhido  
Elisa - natural  
Camada #1  
Q1 x Q2 x Q5:  
Q1 x Q37  
cruzeiros

Navegação de imagens  
50%



Opções de ferramentas

Mover

Mover:

Modo da ferramenta (Shift)

- Pegue uma camada ou guia
- Mover a camada atual

e maior justiça, que  
 saber. Muitos homens  
 diferente, alguns achar  
 injusto. E que ao se  
 e paixões que altera  
 e determina estes dire  
 natural.

O critério da verdade  
 desejar para si o  
 A primeira obrigação  
 dos seus semelhantes.  
 reitos, procederá se  
 terais são os mes  
 de até o de posição

em Londres vai bem Paulo e chegarão  
 eia e Berlim está cal 27 de Novembro  
 esta viagem para Sua. devem ser endere  
 peramos boas notícias Dragalzeu, 3580

Modo: Multiplicar

Opacidade 100,0

Travar:

Camada #3

- José - natural
- José - colhido
- Camada #2
- Elisa - colhido
- Elisa - natural
- Camada #1
- Q1 x Q2 x Q5:
- Q1 x Q37
- cruzeiros

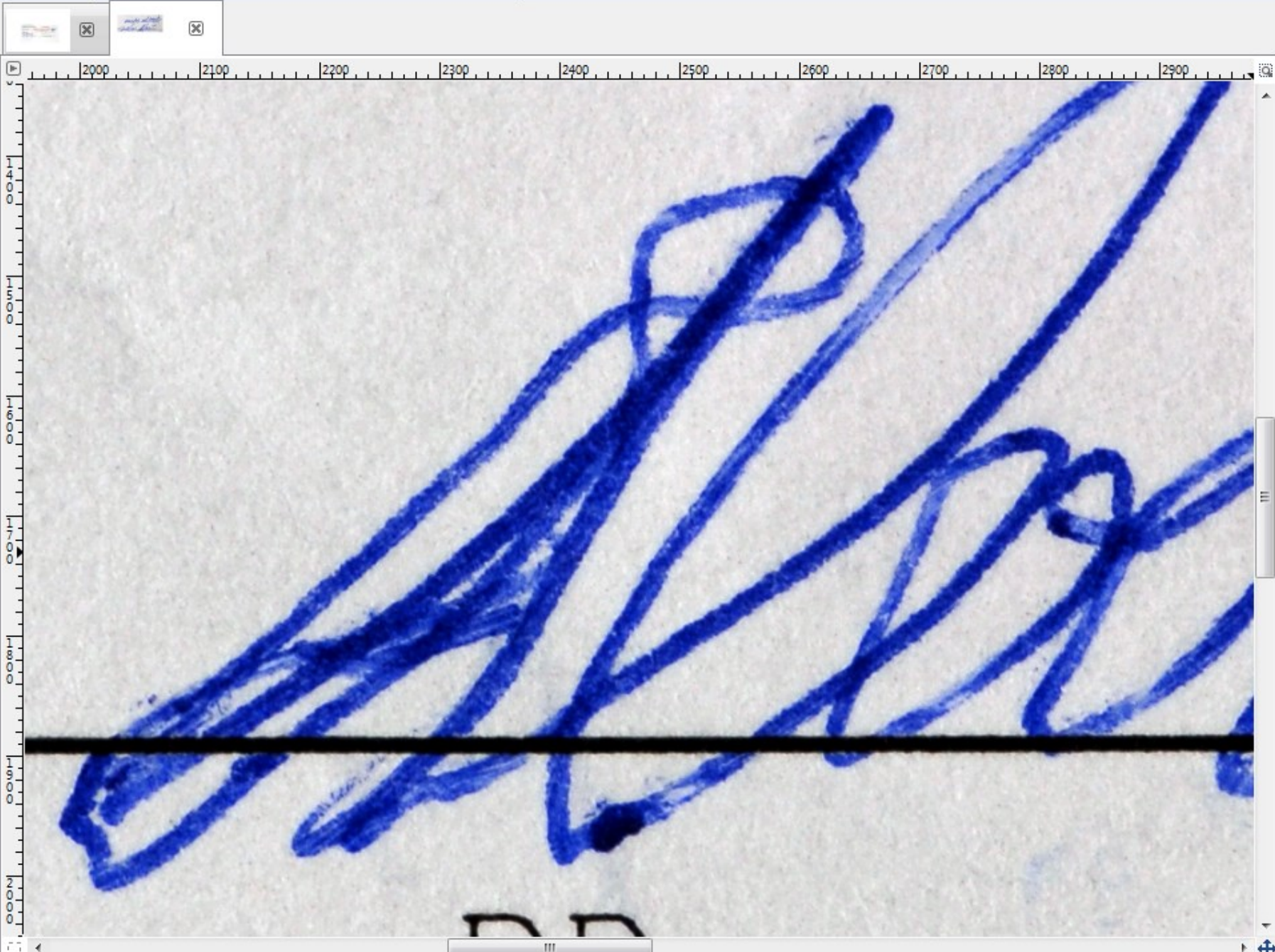
Navegação de imagens

50%



Opções de ferramentas

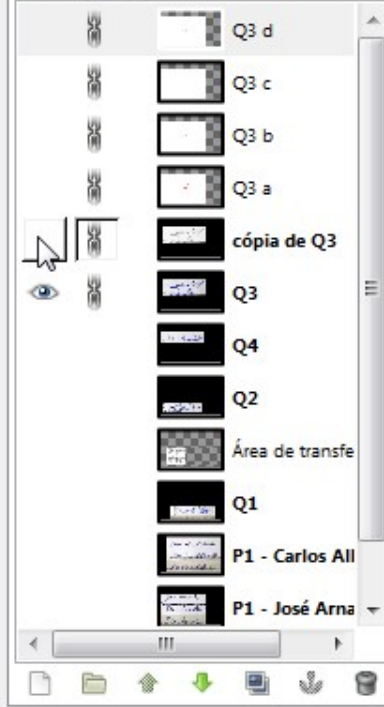
- Mover**
- Mover:
- Modo da ferramenta (Shift)
- Pegue uma camada ou guia
  - Mover a camada atual



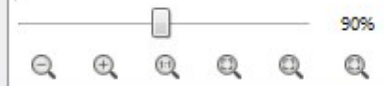
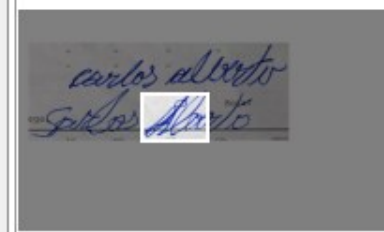
Modo: Multiplicar

Opacidade 100,0

Travar:



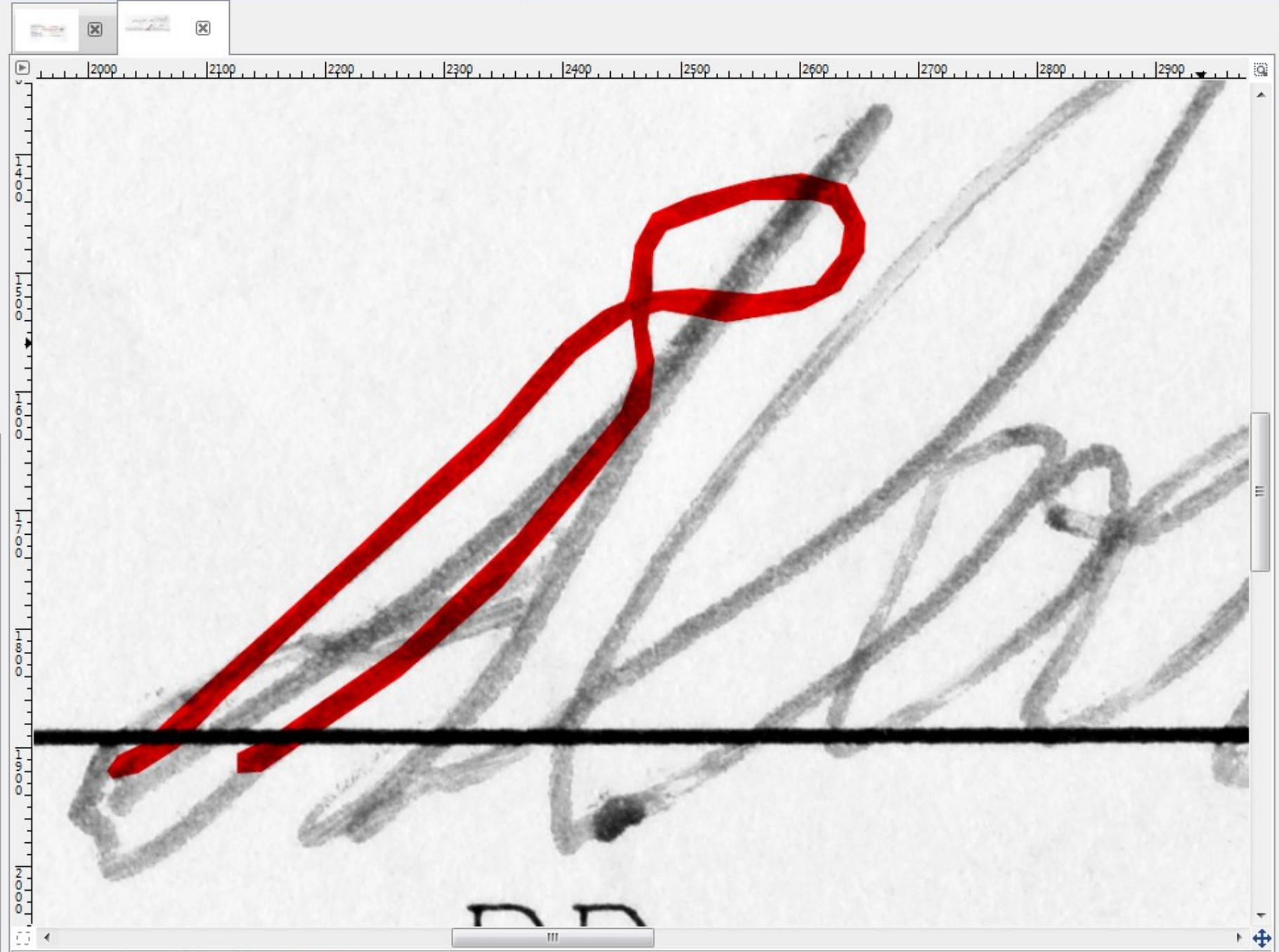
Navegação de imagens





Opções de ferramentas

- Mover**
- Mover:
- Modo da ferramenta (Shift)
- Pegue uma camada ou guia
  - Mover a camada atual



Modo: Multiplicar

Opacidade 100,0

Travar:

- Q3 d
- Q3 c
- Q3 b
- Q3 a
- cópia de Q3
- Q3
- Q4
- Q2
- Área de transfe
- Q1
- P1 - Carlos All
- P1 - José Arna

Navegação de imagens

90%



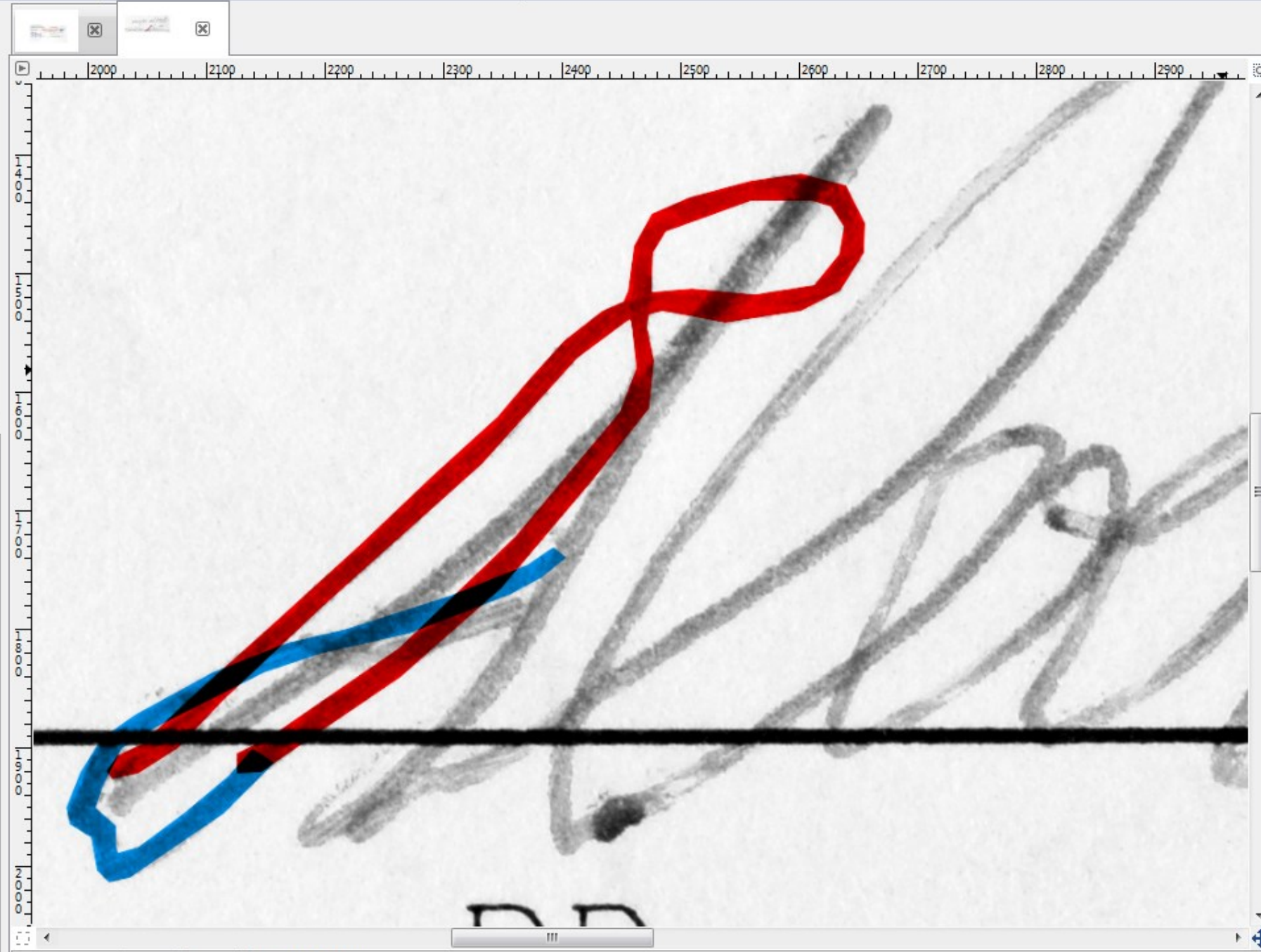
Opções de ferramentas

**Mover**

Mover:

Modo da ferramenta (Shift)

- Pegue uma camada ou guia
- Mover a camada atual



Modo: Multiplicar

Opacidade 100,0

Travar:

- Q3 d
- Q3 c
- Q3 b
- Q3 a
- cópia de Q3
- Q3
- Q4
- Q2
- Área de transfe
- Q1
- P1 - Carlos All
- P1 - José Arna

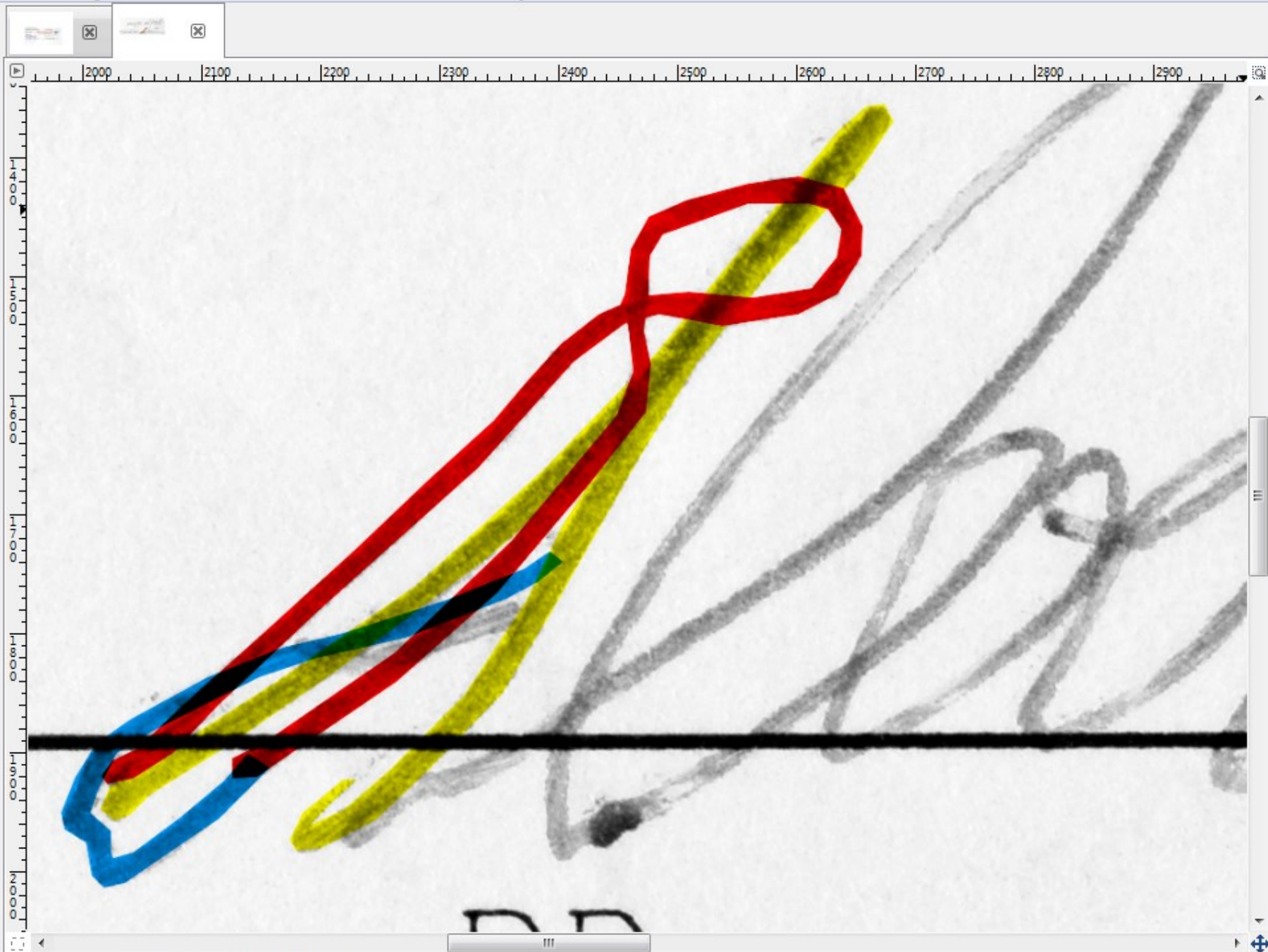
Navegação de imagens

90%



Opções de ferramentas

- Mover**
- Mover:
- Modo da ferramenta (Shift)
- Pegue uma camada ou guia
  - Mover a camada atual



Modo: Multiplicar

Opacidade 100,0

Travar:

- Q3 d
- Q3 c
- Q3 b
- Q3 a
- cópia de Q3
- Q3
- Q4
- Q2
- Área de transfe
- Q1
- P1 - Carlos All
- P1 - José Arna

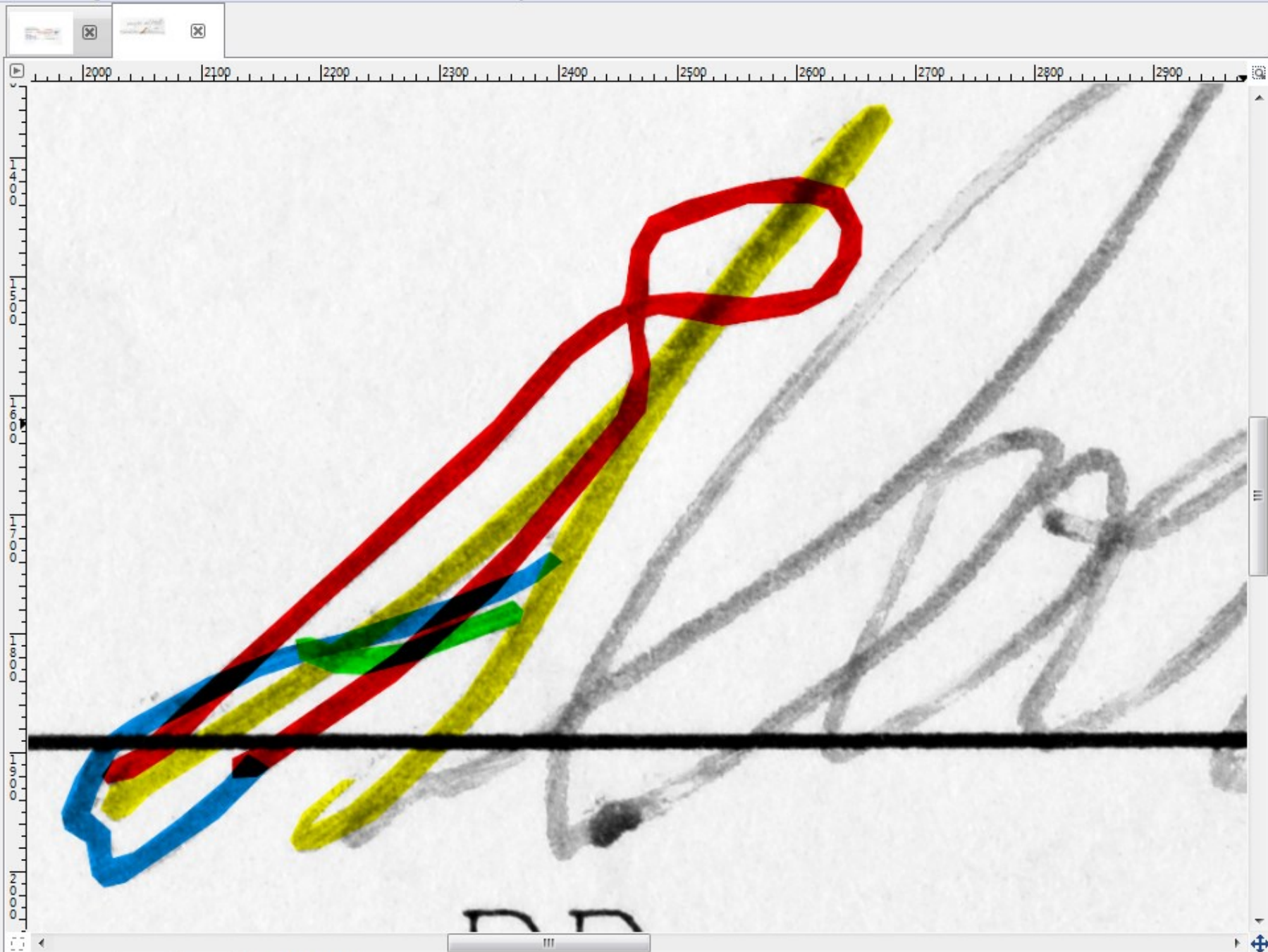
Navegação de imagens

90%



Opções de ferramentas

- Mover**
- Mover:
- Modo da ferramenta (Shift)
- Pegue uma camada ou guia
  - Mover a camada atual



Modo: Multiplicar

Opacidade 100,0

Travar:

- Q3 d
- Q3 c
- Q3 b
- Q3 a
- cópia de Q3
- Q3
- Q4
- Q2
- Área de transfe
- Q1
- P1 - Carlos All
- P1 - José Arna

Navegação de imagens

90%

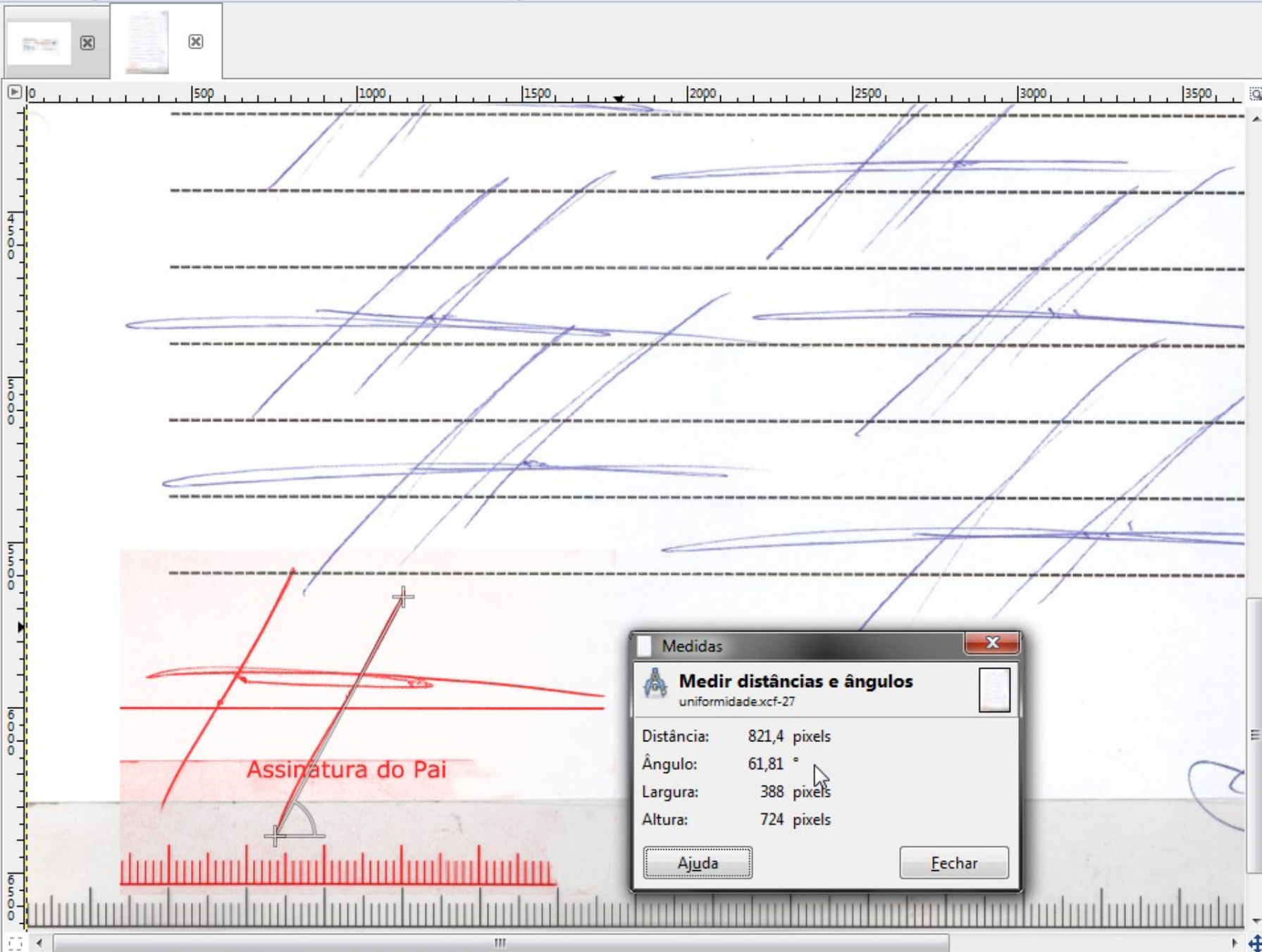




Opções de ferramentas

Medidas

Usar janela de informações



Medidas

**Medir distâncias e ângulos**  
uniformidade.xcf-27

Distância:	821,4 pixels
Ângulo:	61,81 °
Largura:	388 pixels
Altura:	724 pixels

Ajuda Fechar

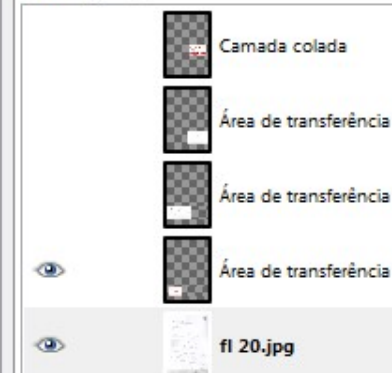
px 25 821,4 pixels, 61,81° (388 x 724)



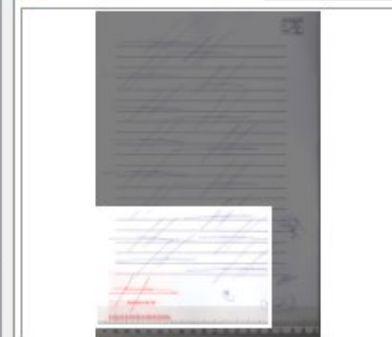
Modo: Normal

Opacidade 100,0

Travar:



Navegação de imagens

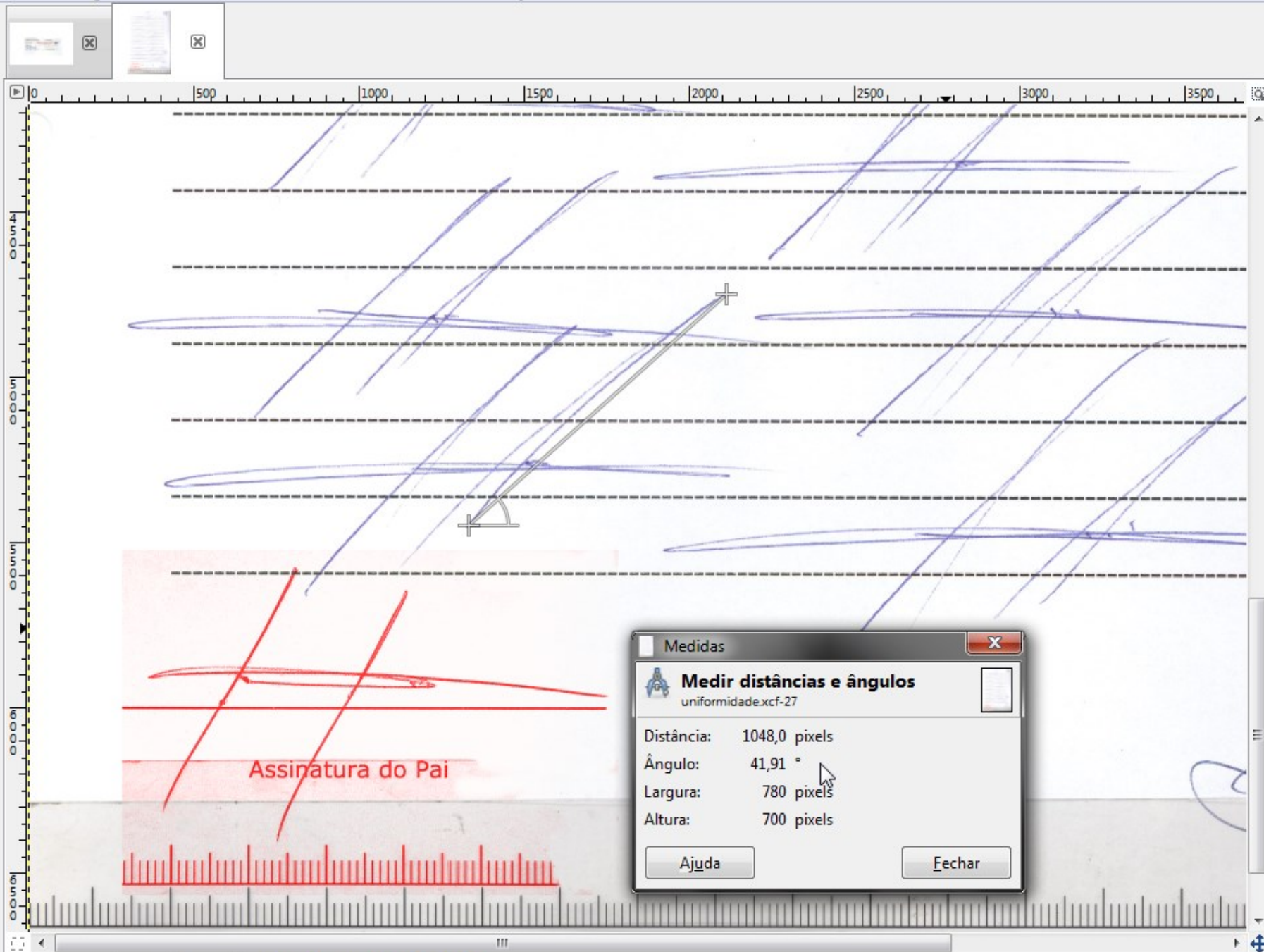


25%



Opções de ferramentas

Medidas  
 Usar janela de informações



Assinatura do Pai

**Medidas**  
Medir distâncias e ângulos  
uniformidade.xcf-27

Distância:	1048,0 pixels
Ângulo:	41,91 °
Largura:	780 pixels
Altura:	700 pixels

Ajuda Fechar

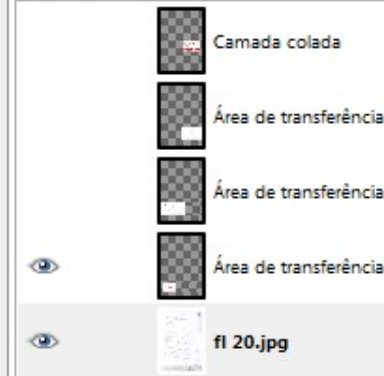
px 25 1048,0 pixels, 41,91° (780 × 700)



Modo: Normal

Opacidade 100,0

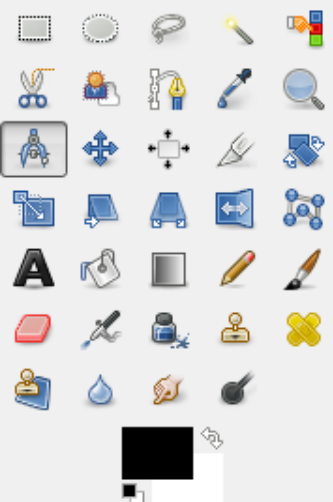
Travar:



Navegação de imagens



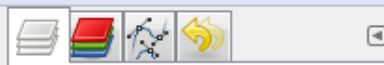
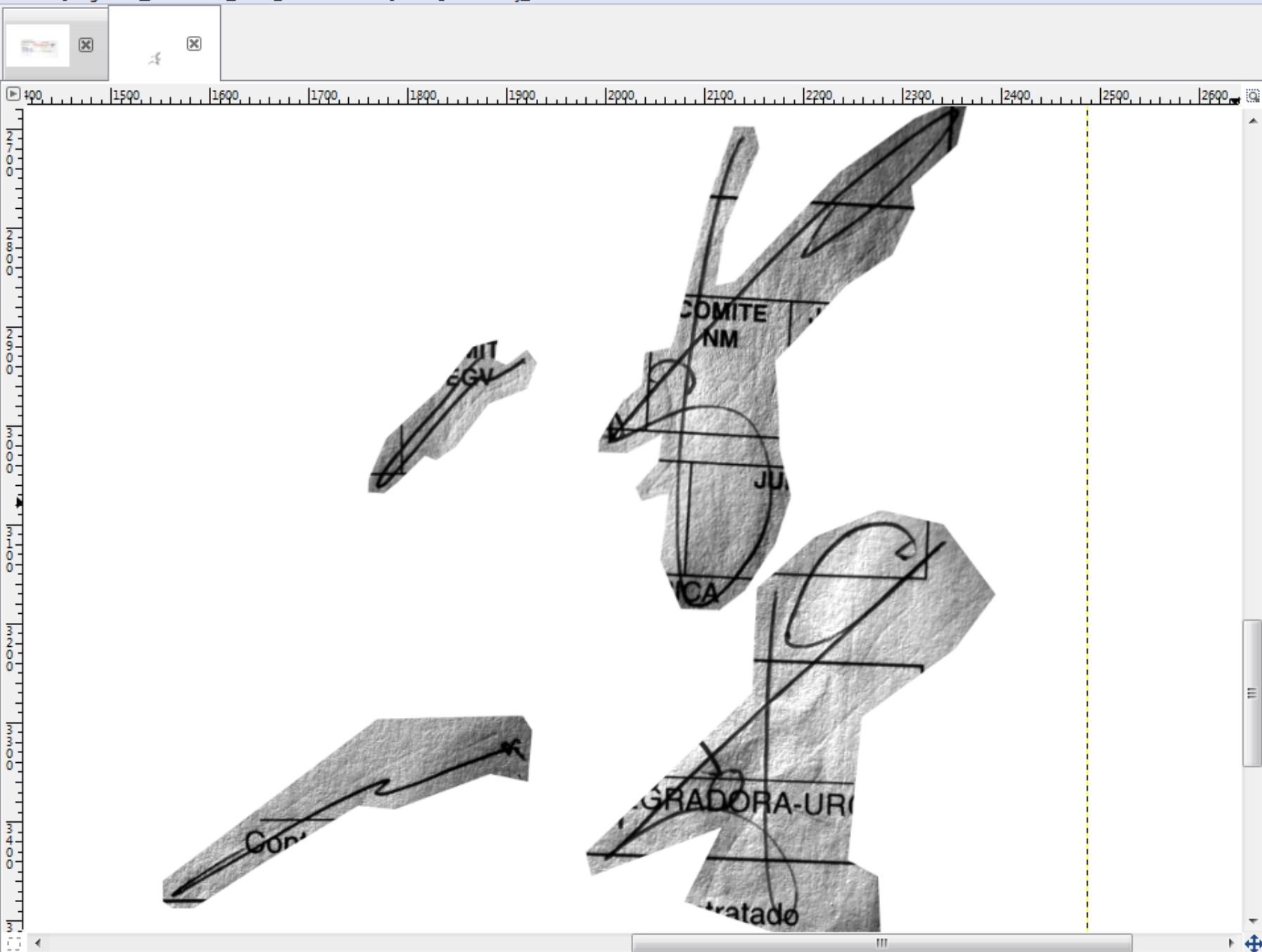
25%



Opções de ferramentas

Medidas

Usar janela de informações



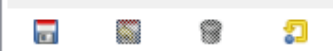
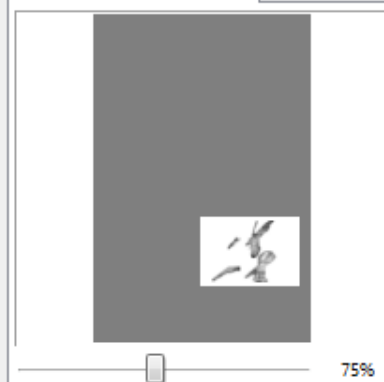
Modo: Normal

Opacidade 100,0

Travar:

- comite egv 1
- comite egv 2
- comite nm 1
- comite nm 2
- DOC 1 (defesa)
- DOC 6 (IPL)
- DSC\_0546.JPG
- DSC\_0694.JPG
- Camada

Navegação de imagens



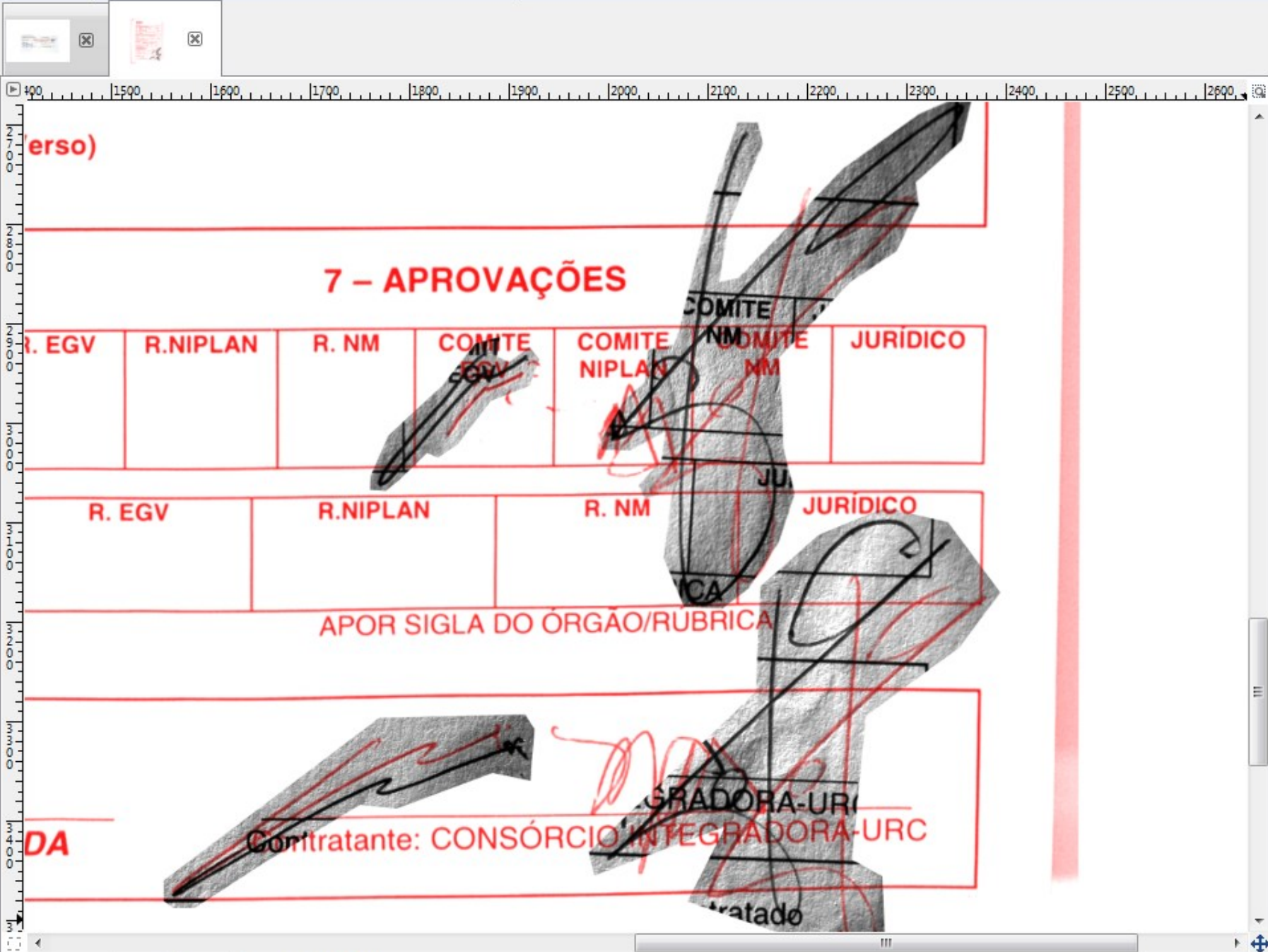
px 75 DSC\_0694.JPG (185,5 MB)



Opções de ferramentas

Medidas

Usar janela de informações



erso)

### 7 - APROVAÇÕES

R. EGV	R. NIPLAN	R. NM	COMITE EGV	COMITE NIPLAN	COMITE NM	JURIDICO
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R. EGV	R. NIPLAN	R. NM	JURIDICO
--------	-----------	-------	----------

APOR SIGLA DO ÓRGÃO/RUBRICA

DA

Contratante: CONSÓRCIO INTEGRADORA-URC

GRADORA-URI

tratado



Modo: Normal

Opacidade 100,0

Travar:

- comite egv 1
- comite egv 2
- comite nm 1
- comite nm 2
- DOC 1 (defesa)
- DOC 6 (IPL)
- DSC\_0546.JPG
- DSC\_0694.JPG

Camada

Navegação de imagens



75%

## 3.4 Image examination

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- The examiner may require the context manager to provide more/better images
  - Different lighting, magnification, wavelength etc.
- The examiner might request additional information to context manager
  - Context manager contacts investigator in charge of the case
- **Sequential unmasking** is possible
  - Submission of standard writings only after examination of questioned writings
  - Maybe not appropriate for all cases

## 3.5 Report

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- Examiner submits draft report to context manager for review
- Context manager reviews the report, then submits all paperwork and original documents to examiner (physically or digitally)
- Examiner assesses if context management was effective
  - If the examiner considers that CIM was not effective, this must be reported to case manager
- If the examiner changes his opinion on the evidences at this point, this information must be included and explained in the final report.

# 4. Conclusion

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- Pros:
  - Contextual information of levels 1, 2, and 3 are minimized
  - Examiner is less exposed to potentially biasing task-irrelevant information
  - Easier to create and assign fake cases to examiners (level 4 – base rate; blind testing)
- Other pros:
  - Original documents less manipulated
  - Possibility to distribute examination requests to other laboratories / agencies
  - Requests with multiple questioned and/or standard writings might be processed in parallel

09-11-01  
YOU CAN NOT STOP US.  
WE HAVE THIS ANTHRAX.  
YOU DIE NOW.  
ARE YOU AFRAID?

This is the Zodiac speaking  
I have become very upset with  
the people of San Fran Bay  
Area. They have not complied  
with my wishes for them to  
wear some nice & buttons.  
I promised to punish them  
if they did not comply, by  
anilating a full School Buss.  
But now school is out for  
the summer, so I punished

## 4. Conclusion

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- Cons:
  - Documents exposed in media reports (CIM ineffective)
  - Documents where the writings contain biasing contents (e.g. "suicide" note)
  - Examiners must be able to use image viewing/editing software efficiently
  - Minimum requirements / set of characteristics needed for images to allow reliable FHE still not defined (this could be very subjective...)



# 4. Conclusion

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- Cons:
  - Resistance to change

*“Many handwriting examiners, for instance, do not favor using digital scans of questioned documents, or only using part of the available handwriting. These may be legitimate concerns, and **research should focus on such procedures**, testing whether the expectation of a decrease in performance (in the eyes of the examiners) due to the absence of “holistic” information is justified.” – Stoel et al., 2015 [emphasis added]*

# Questions?

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Thank you!

**Paulo Akira Kunii**

Forensic expert

Brazilian Federal Police

Contact: [akira.pak@dpf.gov.br](mailto:akira.pak@dpf.gov.br)

